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CONTENTS.

Editorial 327
Resuscitation from Electric Shock 328
Hermann von Helmholtz, by W. F. Magie and C. Riborg Mann 329
Municipal Electric Lighting at Glasgow 330
Annual Meetings of the National Society of Therapeutists and the American Electro-Therapeutic Association 331
Medical Electrical Nomenclature 335
Notes on the Management of Railway Power Stations—I., by George T. Hanchett 336
Electro-dynamic Machinery—X., by E. J. Houston and A. E. Kennelly 337
How to Make a Voltmeter and Ammeter for Amateurs—II., by G. E. Dunton 338
The Convention of the American Street Railway Association 339
Sine Form of Curves of Alternating E. M. F., by Dr. Louis Bell and Dr. J. A. Fleming 339
How to Make a Dynamo Excite Itself, by E. G. Miller 340
Cost of Producing Electrical Energy, by B. J. Arnold 340
Digest of Current Technical Electrical Literature, Compiled by Carl Hering 341
The Electric Canal-Tugboat, by F. M. F. Cazin 344
Underground Wires in Chicago 346
A Novel Application of Accumulators for Traction Purposes 346
A New Vertical Engine 347
A Large Water Power Plant 348
The Roth & Eck Dynamo 348
DEPARTMENTS:
Financial Intelligence 349
Special Correspondence 350
News of the Week 351
Trade and Industrial Notes 353
Business Notices 353
Illustrated Record of Patents 354

A COMMENDABLE POLICY.

The American Institute of Electrical Engineers by having on its programme at the recent monthly meeting two papers, one of a strictly scientific character and read by title only, and another for reading at the meeting of a class that appeals to the electrical profession generally, inaugurated a wise policy, which, we trust, will be adhered to. Papers like that of Dr. Bedell and Mr. Kinsley are not of a character to attract the large audiences which are so useful in maintaining interest in the Institute, and yet are most valuable additions to the *Transactions*. By having, therefore, on the programme, as in the present instance, two papers, one of a character similar to that just referred to, and another likely to draw a large audience, the preparation of the former by members can be encouraged more strongly than in the past, thereby adding largely to the value of the *Transactions*, and the interest in the work of the Institute furthered by the latter through attracting its members more regularly to the meetings.

L'ECLAIRAGE ELECTRIQUE.

A few weeks ago we announced the temporary suspension of *La Lumiere Electrique*, and it now appears that the publication will cease entirely, and with it, of course, that of its satellite, *Electricite*, a wretched little sheet which was apparently published chiefly to obtain exchanges for nothing. In order to fill the vacancy left by *La Lumiere Electrique*, we are pleased to find that a new journal called *L'Eclairage Electrique* has just been started by Dr. P. H. Lebedoer, the first number of which is dated September 15th. It will contain articles from the same writers and collaborators as its predecessor, and the general appearance of the journal is the same, except that it is published in less elaborate style. We regret noticing the absence of those numerous and excellent illustrations for which its predecessor was noted, although the first issue is by no means without illustrations. We find also that an objectionable feature has been continued, the absence of references with dates to the originals of articles which are abstracted from other journals and publications. Abstracts are generally very acceptable to the busy man, but there are many readers who also like to look up the originals, and it is always of interest to know the original date of publication. That several articles in its first issue are from one to four years old, is perhaps not as objectionable in a purely scientific journal as it would be in one claiming to publish news and new matter. A feature which shows the broad mindedness of the editors, and which will please Americans, is that free use is made of scientific matter originating in America. Our new contemporary has our best wishes for its success, though we fear that its high price will form a serious barrier to a large circulation in this country.

THE WESTON STANDARD CELL.

The well known Clark cell has been recognized as a standard to such an extent that it has been recommended and adopted by several Governments as the best reproducable standard of E. M. F., not as a unit, of course, but as a standard by means of which the volt can be reproduced. Any other cell which can be shown to be better might therefore be said to be better than the best,—than the best of that time. The chief objection to the Clark cell is that its temperature coefficient is so great that it must be taken into account, involving considerable trouble and calculation, and at the same time introducing an element of error and uncertainty. Some years ago Mr. Weston showed that by substituting in the Clark cell cadmium and its compounds in place of zinc and its compounds, this temperature coefficient became practically negligible. Although this cell has already been described in these columns, we mention it

again to call attention to a report just published, which comes from that excellent and model, Government Institution, the German Reichsanstalt, and containing the results of the most elaborate, impartial and most carefully made tests yet published on the behavior of the Weston cell. The chief results will be found in an abstract in our Digest, the sum and substance of which is that the Weston cell is in no feature inferior to the Clark cell, and that in several very important features it is far superior. This, coming as it does from such a high authority, we will even say from the highest authority of the present time, is certainly a high tribute to the inventor of that cell, as well as to American scientific research. It is especially so, as it comes from the Germans, who are second only to the English in hesitating to acknowledge the scientific work done in this country. The English will doubtless claim Mr. Weston as an Englishman, but like Elihu Thomson, Mr. Weston has been living in this country a long time and has done all his electrical work here, which makes such a claim absurd, especially when directed to his recent accomplishments.

COLD LIGHT.

One of the most fascinating problems which it will probably be the good fortune of some electrician to solve, is to do that which the tantalizing little firefly knowing nothing about the subject, can do before our eyes, while the greatest scientists on earth are failing in almost every attempt to imitate it. The almost inestimable value of this discovery, which we feel sure will be made sooner or later, is so well recognized that there is no need to dwell upon it again. But while waiting to chronicle the event of its discovery, it gives us pleasure to note any success in this direction, even though it may be only an approach at a solution. Under a somewhat obscure title in a recent issue of a foreign journal devoted to pure science, we find that Prof. Ebert has deduced the laws according to which apparatus should be constructed to produce light by means of high frequency electric currents, without converting most of the energy into heat. A brief extract of his paper will be found in our Digest this week. He has obtained a light of about one-thirteenth of a candle, with an expenditure of only about 1 1500th to 2000th part of the energy required in the amylacetate standard candle lamp. The comparison would, of course, be somewhat less favorable with the incandescent electric light, but nevertheless the difference would still be very great. The light efficiency of an incandescent lamp is said to be about 5 per cent., which means that 95 per cent. is converted into heat and 5 per cent. into light; from this it would appear that the greatest possible efficiency which can be expected is twenty times as great as that of the incandescent lamp, assuming that the 5 per cent. which is now converted into light is converted as efficiently as it is in the cold phosphorescent lights. He furthermore expresses the belief that by proportioning the apparatus according to the laws which he gives, very bright lights (how bright is unfortunately not stated) can be generated with only an expenditure of some millionths of a watt. We hope he, or some one else, will soon prove the correctness of this, in which case the law suits regarding incandescent lamps will cease and incandescent and arc lamps will be relegated to the museums and college laboratories as illustrations of what the past generation did not know. How much of this discovery, if it turns out to be a real discovery, is due to Tesla, would appear after a more thorough discussion of it; at present the researches of Ebert seem to be a mere development of the work started by Tesla in this country.

ELECTRO-THERAPEUTICS.

The great extent to which electricity is applied in medicine is well indicated by the report published in this issue, of the meetings of the National Society of Electro-Therapeutists and of the American Electro-Therapeutic Association, recently held in New York City. In fact, if the remarkable number of papers read were in itself accepted as a criterion, the conclusion would follow that the work being accomplished in this branch much exceeds in extent that done in the industrial departments of the science. Such a conclusion, of course, would be wrong, for in the latter a broad principle once established is easy of application, but in dealing with the complex human organism, but little can be predicated from principles and the treatment for each case must be established independently. Our non-medical readers will doubtless be somewhat puzzled by the medical electrical nomenclature, but it is encouraging to know that the obsolete nature of this terminology is apparently recognized by the medical profession, for it formed the subject of the address of the president of the American Electro-Therapeutic Association. The lines along which to proceed in the desired reformation are given in a paper by Houston and Kennelly, reprinted elsewhere, which, if followed, would place the terminology of the electro-therapeutist on a parity with that of modern science and give a basis that would not in the future necessitate another change. An interesting paper by the same authors read at one of the meetings challenges, and with reason, the recent statement of d'Arsonval in regard to electrical executions. While the conclusions of the French physiologist are admitted as to the desirability of applying treatment to those shocked by electricity, it is shown to be quite another thing to assert that criminals may be revived after being submitted to the electric current in the execution chamber of one of the New York prisons. The remarks of Prof. E. Thomson on the effects of high frequency discharges passed through the human body are of interest as an expression of opinion from such an authoritative source on the various theories that have been advanced on this subject. As will be seen, Prof. Thomson does not endorse the view that immunity from danger is due to the current passing wholly on the surface instead of through the interior of the body, nor the other one that such immunity is due to a condenser effect. The speculation of Prof. Dolbear in regard to the relation of the human organism and magnetism is a bold one, and still more daring is the assertion "that though death may be for the benefit of the race, it is not necessary for the individual." Many other of the papers will be found of more or less interest by the non-medical electrician, which in itself shows a community of knowledge which formerly did not exist, and which will increase when a common language is used for expression.

Resuscitation from Electric Shock.

In connection with the article on this subject by Dr. A. H. Goelet, published in the Electrical World of Sept. 8th, the following paragraph from a very complete report by Dr. Alex. McAdie, of the U. S. Weather Bureau, on "Protection from Lightning" may be of interest:

"If you should be in the vicinity of a person who has been struck by lightning, no matter if the person struck appears to be dead, go to work at once and try to restore consciousness. There are many cases on record proving the wisdom of this course; and there is reason for believing that lightning often brings about suspended animation rather that somatic death. Try to stimulate the respiration and circulation. Do not cease the effort to restore animation in less than one hour's time. For an excellent illustration of a case of severe lightning shock and recovery, due, it would seem, to prompt action by the medical gentlemen present, all who are interested may consult the 'Medical News,' August 11, 1888. A number of cases corroborative of this view are on record in various medical journals."

European Red Tape.

It is stated that the reason why a certain electrically driven carriage from Italy could not take part in the recent competition held in Paris, was that the French custom house officials could not make up their minds what duty to charge for electrical carriages and therefore could not admit this one into France.

Flying Machines.

Lord Raleigh, in discussing the subject of flying machines at the recent British Association meeting, said that "of the five problems to be solved in order to make a successful flying machine, Mr. Maxim has already solved three." Mr. Maxim announces that he now proposes to solve the remaining two.

A Phonograph in Clocks.

According to a French journal, a Geneva firm is manufacturing clocks which talk the hour instead of striking it.

Hermann von Helmholtz.—The Man and the Teacher.

BY W. F. MAGIE.

In one of the many notices of Helmholtz which have been called forth by his recent death, it has been well said that he was distinguished from his German contemporaries by the wide range of his sympathies and by the versatility of his effort. This is certainly true. It is tantamount to saying that Helmholtz was a man of genius, while most of his contemporaries are men of talent. He was a physicist by nature, while they are physicists by education. The German system of education is such that a man of talent and industry is trained to work to the best advantage, and is stimulated to an amount of productive activity which in any other country and under any other system is only the result of individual genius. By confining their efforts within one, and sometimes a very narrow, field, by making themselves masters of everything that can be known in that field, such men, second-rate men, we might call them, are enabled to contribute important additions to science. Their work is, however, rarely if ever epoch-making, and it is often open to the charge of being narrow and out of touch with the work of others. The genius in Germany, on the other hand, is like the genius anywhere else. His mind is open to influences coming to him from different quarters, his glance perceives opportunities for progress in different directions. He distinguishes between fundamental and subordinate questions, and by concentrating his effort upon the former, he builds structures upon the accumulated labors of lesser men which raise science to a higher level. It is in this way that Helmholtz differed from so many of his able and distinguished contemporaries. He was versatile with the versatility of genius.

HERMANN VON HELMHOLTZ.

It is commonly said that Helmholtz was at once a metaphysician, a mathematician, a physiologist and a physicist. Owing to the circumstances of his early life, he became a physician, and some of his first efforts at original work were in the line of physiology. But if the work by which he will be remembered be examined, it will appear at once that he was at heart a physicist, and that all his work in other directions was subordinated to his work in his chosen field. His metaphysical papers dealt with the theory of perception, the one portion of metaphysics which is all important to the physicist, if he would co-ordinate his theoretical study with the results of his observations and calculations. His mathematical work dealt with the fundamental data of physics, time and space, or with questions which naturally arose during the study of physical problems. Much even of his physiological work dealt with the physical questions suggested by the study of the eye as an optical instrument and of the ear as an acoustical instrument. The great bulk of his work was, strictly physical and it was by his versatility and power within the domain of physics that the force of his genius was most clearly shown.

If a scientific man's title to fame can ever be established by one achievement, that of Helmholtz will securely rest on one of the earliest of his productions, the immortal paper on the conservation of energy. This paper was not the first in which this principle was propounded. It had been discussed by Joule, Mayer and Mohr, to say nothing of the various hints of it which active investigation, enlightened by modern knowledge, has discovered in the works of older writers. But Helmholtz's paper has a character of its own. Joule devoted himself to prove the equivalence between heat and energy, without establishing the universality of the principle; Mayer expounded the principle but gave no adequate reasons for its acceptance; Mohr developed a speculative view of the structure of bodies and their energy relations, which in his time, at least, was a pure speculation and nothing more. With a wider philosophical outlook than Joule, and with a more thorough grasp of physical facts and principles than Mayer, Helmholtz treated the conservation of energy as a general principle, exhibiting its relations to attracting systems, to heat, to electrical and chemical actions, and to organic life. His arguments were drawn from all departments of physics, they were logically reasoned, and were based on known facts. One might have been pardoned for refusing assent to the principle when supported only by Joule's mechanical value of heat, or by Mayer's or Mohr's speculations, but from Helmholtz's argument there was really no escape. It is to him, more than to any other, that science owes the principle of the conservation of energy in its present form.

The paper on vortex motion in fluids should be reckoned as the next in importance of Helmholtz's contributions to science. It is interesting in itself as an extension of hydrodynamics, but its value can only be appreciated when we remember that it served as the starting point for much of the modern theoretical physics. Its services in the development of Maxwell's theory of magnetism and electricity, and in furnishing the basis for the vortex atom theory of matter proposed by Lord Kelvin, can hardly be over stated.

By the invention of the ophthalmoscope Helmholtz opened the way to a scientific study of the eye in health and in disease, and in his treatise on physiological optics he carried that study to a high degree of perfection. In a similar way he enlarged the scope of the ancient science of acoustics. By his analysis of complex tones, he showed a beautiful order in what had been before considered a chaos, and united the science of acoustics and the art of music by the most intimate relations.

Thermodynamics owes to Helmholtz considerable extensions, especially in the field of the relations between electrical and chemical actions and heat. His study of electric currents is also of great importance and his introduction of the kinetic theory of matter into optics and his explanation, on that theory, of anomalous dispersion should not be passed without mention.

In Germany every investigator is also a teacher. Scientific men are glad to receive the stimulus which comes from the necessity of presenting their views to students, and the students receive from them an incentive to original work as well as a model of the way in which that work should be conducted. It is not necessary that the lecturer should have all the graces of the platform orator or that his experimental illustrations should be always striking and brilliant. It is his business to think before his class and to instruct and excite them by an exhibition of the working of the scientific mind. In our ordinary sense it can hardly be said that Helmholtz was a great teacher. His lectures were well delivered, in beautiful and intelligible language, but there was a certain halting and uncertainty, a feeling, as it were, for the thought and a strange inaccuracy in stating the details of an argument, that in a popular lecturer or in one of our college professors would be set down to a failure to grasp the subject. His blunders in the use of the sim-

plest mathematical expressions were notorious; and, at least in the later years of his professorship, when the preparation of his experiments was left to his assistants, it was no uncommon thing for the lecture to come to a standstill, while refractory apparatus was being pushed and pulled, adjusted and readjusted, in the effort to present an illustration which would not come. In the laboratory, also, there was none of that constant personal supervision to which some of the German professors devote so much of their time. The daily tour of the laboratory was very brief, and a student might work for weeks without receiving a visit. But in the highest sense of the word, Helmholtz was a great teacher. His presence was an inspiration. His lectures opened to his hearers the view of a great mind working on problems which had for it a living and not merely a didactic interest. Even the commonplaces of elementary physics were illumined by the light of genius. In the laboratory, when the worker was in difficulties and asked for help, Helmholtz's advice was always pertinent and valuable, and when he was making progress, no encouragement could be more gratifying than the interest with which his report was listened to and the "good" with which the interview terminated. Helmholtz's students used to complain sometimes of the lack of attention which they received, but it was generally true that they were neglected only when their work was making no advances and when their teacher's visit would have been of little or no assistance, either for advice or for encouragement. His fertility of mind in suggesting new and important problems for investigation was remarkable. The work that was turned out of the Berlin laboratory under his directorship was of a high order of merit and of permanent value. His vast reputation as a thinker, his sympathy with good work and his evident scorn of poor and useless work, his shrewd advice and his warm appreciation of success, combined to make him what a great teacher should be, a leader of the minds of others.

BY C. RIBORG MANN.

In the death of Hermann von Helmholtz the world has lost not only the greatest scientist and teacher of his generation, but also one of her kindest, most genial, and truest men.

All students of natural science are so familiar with the many new discoveries in that realm which were the results of his labors that I will not attempt to give any further information on that point.

It is not only because he was a great scientist that he commands our homage, but also as a great teacher and man that his memory will be cherished with greatest respect. Notwithstanding all his attainments, all the honor that was showered on him from every side, he never lost that quiet modesty which is one of the marks of genuine greatness and true genius. In society, just as everywhere else, he was a man of few words. He did not have much to say in a general conversation, but what he did remark was very much to the point. As a teacher he was an inspiration to all who came into his laboratory. It never made any difference what your trouble was, what bug you had found or was hunting on your apparatus, Helmholtz was always able and ready to help you. Nevertheless he did not seem to regard himself as any great authority. Often I have seen him make a long mathematical deduction and bring out the wrong result. When this happened he was never in the least embarrassed, but would remark, "Well, gentlemen, I seem to have made a mistake here somewhere." Then he would either go back and work it over, or more generally the case leave it to the students for correction.

He always liked the American students and said that they gave him the best papers at examination, as they arranged their thoughts in a much more connected way than the most of the Germans. He made many friends here in America when he visited the World's Fair, every one being attracted by his genial, kindly manner. It was his first trip to America, and, though he dreaded it beforehand, was afterwards glad that he had taken it.

He was a man of deepest personal sympathies. No one could listen to his words when he spoke at the funeral of his colleague, Prof. Kundt, and see his emotion, without being impressed with the fact that they were heartfelt words and deep emotions that stirred him.

Little did he think at that time that he would be the next great scientist to pass onward; little did we imagine that this year would add to the names of our great masters Herz Tyndall, and Kundt, that even greater name of Helmholtz on the list of the distinguished physicists who have let us.

But he has gone and we have lost the inspiration of his presence—an inspiration which is at best only imperfectly felt in his works and his memory.

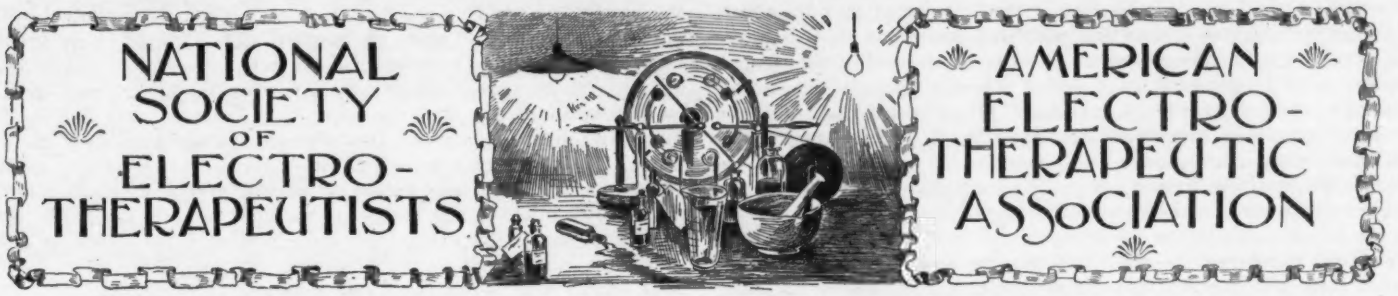
Municipal Electric Lighting at Glasgow.

(From our own English Correspondent.)

The honorable record of our municipalities in the matter of financial administration has rendered the public somewhat indifferent to the possibilities of corruption involved in the general undertaking of electric lighting by them. The main objection urged against municipal electric lighting was that municipalities were at any rate sure to so mix up their gas electric lighting and other accounts that it would be impossible to find out exactly what was the loss or profit on any one of the constituent items. So far, however, even this foreboding has not been fulfilled; indeed, clear as are the accounts of our electric lighting companies, those of our electric lighting municipalities are if possible still clearer. A good example of this is the financial statement that is published by the Electric Light Committee of the Glasgow Town Council for the year ending May 31, 1894. In these accounts the capital expenditure is allocated under no less than 14 different headings, so that it is possible, without any trouble, to put one's finger immediately upon any undue source of expense. Not content with this, however, the committee have commenced in a most business-like way to write off large sums for depreciation, notwithstanding the newness of the plant, and the fact that had they refrained from doing as they might well have done, the electric lighting venture would have resulted in a handsome profit instead of a small loss. The depreciation, moreover, is also carefully allocated to the different items of capital expenditures, 1 per cent. being written off buildings, 7½ per cent. off machinery, 10 per cent off accumulators, and 2½ per cent. off mains. At the same time that one must gladly confess that these accounts and others of the same kind are perfectly satisfactory as regards straightforwardness, and even as regards profit and loss, seeing that in the second year of the undertaking the loss has been reduced to a little over £600, with £4,400 set aside for depreciation, £3,400 devoted to interest on loans, and £1,200 devoted to the loan redemption fund, yet notwithstanding several favorable circumstances, the Glasgow undertaking does not show that municipal management leads to anything noteworthy in the matter of economy. The price per kilowatt hour was until recently 7d., and only since the first of June has it been reduced to 6d. and this at a place where coal is cheap and fuel is supplied to the central station at a normal price in the shape of gas coke from the municipal gas works. The price now ruling in London, where coal and everything else is dear, is 6d, with a day supply at 4d. Again, notwithstanding the fact that some 30 per cent. of the energy generated by the station supplied is applied to public lighting purposes, involving a steady load for long and definite hours, the Glasgow Municipality is unable to generate a kilowatt for less than 2d., whilst in Kensington, with all the disadvantages under which electric lighting labors in such a neighborhood, the figure is only ¼d. more. When we come to the total expense of generating a kilowatt hour, the Kensington Company is able to do it for 4¼d., whilst the Glasgow Municipality is unable to do it for less than 4¾d. I may mention that the system of both these concerns is identical (three wire system with accumulators) and their capital expenditure and output are of the same order of magnitude. Whether due to bad meters and other measuring instruments or to an inferior system of underground mains, the percentage of energy unaccounted for at Glasgow is abnormally high for an English electric lighting undertaking. Last year 26 per cent. of the energy generated was apparently lost. This year, it is true, considerable progress has been made in diminishing this loss, but it still stands at over 16 per cent. To give an idea of the Glasgow undertaking, I may mention that the capital expenditure up to date has been close upon £120,000; last year the output in kilowatt hours was over 850,000, and the revenue £18,000, the number of customers connected to the mains being close upon 400. It is certainly satisfactory that municipalities, if not making a marked financial success of their undertakings, are at any rate managing them with ordinary ability and extraordinary honesty, since before another twelve months have elapsed the number of our municipal undertakings will be portentous. Within the next few months new municipal stations will be in operation at such important towns as Leicester, Worcester, Cardiff, Ealing, Cheltenham, Belfast, etc.

A Doubtful Compliment.

In a communication to a London contemporary, an Englishman remarks: "Actual experience, even though American, is a safer guide than purely theoretical considerations."



THE NATIONAL SOCIETY OF ELECTRO-THERAPEUTISTS.

The second annual meeting of the National Society of Electro-Therapeutists was called to order by the president, William Harvey King, M. D., of New York City, at the Berkeley Lyceum, on Thursday, September 22, at 11 A. M. The members present represented almost every State in the union.

The president's address, "Electro-Therapeutic Teaching," was an able argument in favor of having this subject taught in every medical college in the land.

"The Electrical Treatment of Appendicitis," by W. N. Williams, M. D., San Jose, Cal., was the first paper read. As he had used it in connection with other remedies, he could not say that his patient was benefited by the galvanic current as he applied it.

The next paper was on "How to Measure the Faradic Current," by Harry F. Waite. In order to accurately measure the current there should be known the rate of alternation, the amount of current in the primary coil, the distance the secondary covers the primary and the details of construction of the secondary coil. In case the old style vibrator is used in the primary circuit, it is only necessary to know the amount of current in the primary coil, the distance the secondary covers the primary, and the details of construction of the secondary coil.

"An Investigation of Interpolar Action in Galvanic Currents," was the subject considered by William L. Jackson, M. D., of Boston. The doctor used the zinc-carbon cell, bichromate of potash solution, arranged in two batteries of 30 cells each, Waite & Bartlett pattern. A piece of fresh beef 12 centimeters long by 4 square, carefully prepared so that the fibres ran lengthwise, was fastened by rubber bands to a glass plate and two bare copper electrodes were applied, one to each extremity, and a current, ranging from 10 to 60 milliamperes, was passed through the meat. The resistance varied with the different currents used, diminishing with the stronger current. The negative end of the meat was moist and juicy and apparently unchanged and the metal electrode was unchanged and easily removed; but the positive electrode was adherent and corroded, and the surface of the meat had an apple-green stain which extended into the tissues. The current was now increased to from 105 to 650 milliamperes, and the positive end of the meat was affected as before; but, at the spot where the negative electrode was in contact, there was a brilliant crimson color, and the untouched meat was decidedly paler. The ends of the meat were now covered with moist clay and the electrodes applied to the clay. Seventeen milliamperes were passed; the resistance was increased to 224 ohms. The meat was now trimmed so as to make an hour-glass contraction having a diameter of 1 centimetre. A current of 5 milliamperes now met with a resistance of 760 ohms. As soon as 60 milliamperes were allowed to pass the meat began to smoke, turned white, was too hot to be comfortably handled and drops of serum began to ooze out. The color now became brownish, juice more abundant, a sizzling was heard and an odor of cooking meat was perceptible. The area of change was limited to about one centimetre, but it gradually broadened at the end of three minutes and was fully two centimetres wide. Suddenly there was a slight explosion at the point of most marked action and immediately the current began to decrease, and at the end of 5 minutes the current was 150 m-a and shortly after it feel to zero. The negative electro was now found to be bright and clean, with an increased moisture around it. The positive electro was adherent, and it was removed with difficulty; the metal was corroded and the clay was dry and clung tenaciously to the meat. The ends of the muscle had a whitish, sodden appearance, but it was deeper at the positive end. Upon dissection the interior was found to be quite warm, the bright red had disappeared and it had a less juicy look. All resemblance of muscular fibre had disappeared from the narrow portion, and it was of a yellowish-brown color, tough and grizzly and felt like a hardened cord. This clearly shows that there was an electrolytic action between the poles.

President King read two papers, one on "Some Observations on the Influence of Electricity in Muscular Developement," in which he gave his experience with faradism and the galvanic current to develop strength of muscle of the forearm. The conclusions were in favor of the galvanic current. "The Clinical Uses of Electricity in Muscular Development," treated of the congenital defects in muscles. By treating the motor points of the muscles there was an increased nutrition and strength and peevish, fretful children had become cheerful, where there had been a lack of strength or growth of a muscle and it was unable to cope with the antagonistic muscle or muscles; causing a slight deformity, particularly noticeable when the child tried to run or step quick, sometimes causing him to tumble. These cases which the doctor treated showed a marked improvement in their mental condition as well as in the muscles.

"In a paper on "Hints on the Use of Electricity in Gynæcology," by Flora A. Brewster, M. D., of Baltimore, it was shown that uterine hemorrhage is promptly relieved by the galvanic current on account of the stimulus given to the nervous system, sending increased vital forces to the blood vessels, and so increases their tone that their calibre is diminshed and their walls are so strengthened that they retain the blood and send it promptly on its course to the heart. A strong galvanic current passed through the small intestines from the six lower dorsal vertebræ will constipate the bowels. A weak galvanic current in the same direction will act as a tonic and the peristaltic movements will be increased. If all the spinal nerves are galvanized the heart's action will be increased. Galvanization of the vagi stops the heart's action. If the current is directed from the spine to the cervix (positive to the spine and negative to the cervix) most powerful contractions of the uterus will occur. Galvanization of the blood vessels diminishes their calibre. The positive pole will coagulate blood and the negative will make t more fluid. The galvanic current has a chemical effect and the faradic has largely a mechanical effect. Faradic currents from a short, coarse wire will excite more acutely the sensibility of subcutaneous organs. The current from the coil of long, fine wire acts especially upon the cutaneous sensibility and penetrates more deeply into the tissues. The current from the coarse coil is more easily localized in its action.

F. M. Frazer, M. D., of New York, in a paper on "Radical Electrolysis," expressed the belief that in radical electrolysis there is a process different from anything heretofore used, and it is particularly adapted to those conditions where the negative pole is indicated and local action on the mucous membrane is desired. It is not to replace or displace anything we now use, but it is designed to add one more specalized method to the armamentarium of the electro-gynecologist.

M. Milton Weill, M. D., of New York, exhibited and explained an electrical endoscope, laryngoscope and stethoscope, and explained their uses. The endoscope has a small electric light of about one-eighth candle power.

"Post-Diphtheretic Paralysis Treated by Electricity, by William L. Jackson, M. D., of Boston, treated of a case of the disease where static electricity, negative insulation, positive breeze, and massage and sparks were applied to the weakened muscles and to the spine; length of treatment 20 minutes, followed by half an hour in a recumbent position. There were intervals of from two to six days between treatments. Rapid progress was made in the improvement and in two months the patient reported that she had danced. She was discharged cured in six months.

"Brief Researches on the Action of Galvanic, Faradic and Franklinic Currents on Nervous Tissue," was the subject of an able paper by Walter F. Cowl, of Berlin, Germany, which, in Mr. Cowl's absence, was read by J. G. O'Connor, M. D.

"Electricity in Aural Diseases," by Henry C. Houghton, M. D., of New York. The action of a current of electricity in the ascending or descending direction and the effects produced at the point of entrance to or exit from the body determine the question of therapeutics. An eustachian electrode was devised by the author and consisted of an eustachian catheter through which was passed a wire which ended in a spherical tip at the small lumen; the

wire was secured by a thread and met at the larger end in which a tip could be placed connecting with the rheotome and battery. In place of the speculum formerly used is an electrode made with a central wire terminating in a small spherical point over which a sponge or charpie could be drawn and secured by a small piece of hard rubber tubing varying in size according to the calibre of the external meatus; this, dipped in a weak saline solution and introduced well into the auditory canal, concentrates the current without the annoyances and dangers of maceration of old scar tissues to which one is liable in the use of hot water. For bringing within the circuit the tissues of the lower pharynx and anterior and posterior muscular structures, a tongue spatula, with insulated shank, is connected with the ordinary universal handle. A spatula electrode having a platinum surface superiorly and a porcelain surface inferiorly, and bent at straight angles to the stem so that it can be pressed against the posterior part of the hard palate, is now used.

A paper on "A New Method of Treatment for Gouty Arthritis of the Fingers," by Frank A. Gardner, M. D., of Washington, D. C., described an electrode for this purpose consisting of a glass vessel, about six inches square and four inches deep, filled with potter's clay. At its bottom is a metallic plate attached to a binding post on the outside. He attaches a large clay or felt electrode about 8 inches square to the positive pole and applies it between the shoulders, and the negative pole is connected with the binding post of the new electrode. The fingers are buried in the clay so as to cover all the joints involved and a current of from 20 to 50 milliamperes is passed for fifteen minutes, if agreeable to the patient. The strength is gradually increased at each sitting until 45 milliamperes can be borne for fifteen minutes.

"Inter-Uterine Cataphoresis," by W. H. King, M. D., of New York, was a paper which invoked a good deal of discussion; in it the doctor stated that the first instrument he used was a small platinum sound on which a small film of cotton was wound, and this carried the medicinal agent into the cervical canal. There were so many objections to this that he secured a staff of hard rubber tubing about 8 inches long; one end was split to connect with the rheophore, and on the other was screwed a hollow tube or receptacle for the medicament; through this tube runs a copper wire to within half an inch of the end, where a platinum wire is soldered to it, and this continues for one inch beyond the end of the shaft of tube and is thoroughly sealed to prevent the leakage of the medicine. A hollow sheath with longitudinal slits is screwed over the end. By a slight rotation of the electrode the whole surface of the membrane can be brought into contact with the opening of the sheath. There are three sizes of this sheath, so that one can be selected to completely fill the cervix or the body of the uterus. The cervix is dilated, if necessary, and the electrode dipped into the liquid to be used and the application made, the active electrode having been connected with the positive pole and the cathode placed on the abdomen, and a current of from 15 to 25 m-a is passed for from 8 to 10 minutes.

"Cicatrix and Stenosis of the Cervix Uteri Treated by Electricity," was the subject of a paper by Alice B. Condict, M. D., of Orange, N. J. The doctor removes the cicatrix by the application of the galvanic current; the cathode (aluminum) is applied to the cervix and a large positive pole upon the abdomen, and 15 milliamperes is passed for 10 minutes. Treatments are given twice a week and in about three weeks an improvement will be noticed. In two months the cervix, in a case she related, became normal in texture and had assumed a pink hue.

"A Case of Dysmenorrhoæ" was considered by Bessie P. Haines, M. D., of St. Paul, Minn. The doctor uses the primary faradi current and regulates the intensity by the endurance of the patient.

A paper on "Important Points in Selecting Electro-Therapeutic Apparatus," by T. F. Livingston, M. D., of New York, advised against purchasing cheap wares. The faradic cell should be constructed for a given form of battery to operate. The coil should contain many thousand feet of wire so adjusted that the lines of magnetic force are cut in proportion to the selected form of battery to operate, thus utilizing the greatest possible amount of induction. The core or magnetic field requires careful adjusting, together with the primary cell. A perfect vibrating device should be secured and it should allow all possible adjustment as to unison of vibration and the magnetic field so constructed as to adjust the distance between the vibrating spring and the magnetic attractive piece, thus allowing for the increased or decreased electro-motive force as cells are added or removed from action. The platinum tipped screw making contact with the vibrator should be constructed so that it can be adjusted longitudinally along the vibrator and allow perfect adjustment. The screw point should be made with a view to reduce sparking, thus avoiding the oxidation of contact. The contact posts must not allow dust to settle to interfere with contact. There should be as few switches as possible, the contact pins should be arranged on top of the base, and switches so constructed that they can be readily removed by the operator. All contact parts should be perfectly soldered. A small apparatus should not be bought as the necessary parts are not included. In a galvanic battery, there should be fair-sized plates, ready means of current manipulation, a simple device for immersing the plates in the fluid, a hydrostat that will allow the plates to be easily immersed; a device for electing cells singly, without shock; a pole changer and an interrupter. The cups should be either of rubber or glass and of good size.

In a "Report of Clinical Cases," Mr. Bonner Flinn, M. D., of Worcester, Mass., described a number of cases where electricity had been applied as a treatment with entire success.

In a paper on "Electricity as a Therapeutic Agent," by W. S. Watson, M. D., of Fishkill, N. Y., the belief is expressed that electricity is of great value in nervous diseases, and that if such cases were treated in season much insanity would be avoided. Slight maniacal excitement, melancholia, and hypochondria are curable by modern methods aided by electro-therapeutics. The doctor thought that insane asylums should be completely equipped with electro therapeutic apparatus.

"Researches on the Action of Galvanic, Faradic and Franklinic Currents on Nerve Tissues," was the title of a paper by Walter Y. Cowl, of Berlin. The difference between galvanic, faradic and Franklinic currents was shown and illustrated by analogies decribing the various effects of these different currents on nerve tissue and the following conclusions were reached: 1. That, when of the same maximum intensity, a relatively gradual rise, as in the faradic closure current, produces much less effect than an instantaneous one. 2. That the faradic, like the momentary galvanic current, produces nervous incitation only by its rise and not by its fall. 3. That down to a very short period of excitation—in the present researches one-thousandth of a second—a difference in the amount of incitation, effected by an instantaneously arising current, varies only with the intensity and not with the quantity of electricity employed. 4. That, in contradistinction to the Franklinic current of enormous intensity and almost infinitesimal duration, both the faradic and the galvanic current of moderate intensity and decidedly greater, yet very minute duration, will produce no appreciable excitation, instead of an energetic response.

"An Apparatus for the Application of Heated Oxygen, or Ozonized Oxygen by Electrical Propulsion," was described by Irving Townsend, M. D., of New York. This is an attachment to the G. B. Underwood inhaler, and consists of an Edison Lalande battery of three cells, which decomposes a current of pure oxygen gas into ozone, and at the same time a second circuit, by means of a small motor, runs a small fan and thus keeps up a current of air and ozonized oxygen, mixed in any desired proportion, and which is forced through the heated cylinder of the inhaler. The apparatus consists of the inhaler, a cylinder of pure oxygen gas, the ozonizer, a small motor, a fan and the Edison battery.

A paper on "The Value of the Galvanic Crurent of High Amperage in Diseases of the Liver and Splen," by Lorenzo J. Kohnstamn, M. .D, of N. Y., gives the result of investigations as follows; That the direct action of the galvanic current upon the red blood cells is on of the nutrition, and that it improves the condiion of the blood dises, increasing their color and lessening the amount of the small sized dises. There is a two-fold action of the galvanic current—an elctrolytic acion, from which direct disintegration and separation of organized tissues occurs, and a galvano-chemical action, the results of which follow from by the action of acids or alkalies at either pole. Of the various forms of electricity the galavnic current is the only one which is of positive value in the treatment of diseases of the liver; galvanism of low ampherage is valueless, while the high ampherage cannot be used on account of its strong local caustic action; the galvano-interrupted current of high ampherage is the only one indicated, and, in the absorption of exudates or in stimulation of a gland, hyperaemic in action or passive state, it is the galvano-chemical action of the current which brings about the desired result.

A paper on "Electrical Massage in the Treatment of Diseases of the Ear," read by Thomas L. Shearer, M. B., C. M., of Baltimore, recommends that treatment in acute inflammatory conditions about the ear or where marked pain is present; but too sudden impact of vibrations, when very coarse and loud, will produce a marked degree of nervous shock in people of nervous temperament. Treatments should begin with sittings of ten minutes—two minutes with the slowest vibrations, three minutes with the

medium and five with the fast vibrations, taking care to test the susceptibility of the patient and proceed slowly, and not to prolong the massage in most cases over twenty minutes. In proper cases the patient says after treatment that there was a sensation as if air had been blown through the head from ear to ear. The best results are obtained where a moderate catarrhal condition of the eustachian tube exists.

It was resolved that the society hold its next annual meeting at Boston in September, 1895, and that the exact date and hall be left to the discretion of the Executive Board.

The officers elected for the ensuing year are as follows:

President, William L. Jackson, M. D., Boston; first vice-president, E. S. Bailey, M. D., Chicago; second vice-president, Frank A. Gardner, M. D., Washington, D. C.; secretary, Clara E. Gary, M. D., Boston; treasurer, J. B. Garrison, M. D., of New York; executive board, the officers of the society and William H. King, M. D., of New York, and M. D. Youngman, M. D., of Atlantic City, N. J.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The Fourth Annual Meeting of the American Electro-Therapeutic Association was held last week in the New York Academy of Medicine. The session lasted three days, September 25th, 26th and 27th, and the programme consisted of the reading of scientific papers bearing upon the application of electricity to medicine.

The president's address—"The Function of the American Electro-Therapeutic Association"—was read by Dr. W. J. Herdman, of Ann Arbor, Mich. He spoke of the remarkable activity and interest that seems to have been awakened in all that relates to electro-therapeutics since the organization of the association a few years ago, and gave a brief historical outline of its work; he then stated the various needs of the Association, and also spoke of the necessity of having a cosmopolitan language in electrical science. "Words must mean the same to the electro-therapeutist that they do to the physicist. For the sake of simplicity, clearness, and in the interests of progress, the electro therapeutist must be willing to lay aside his 'galvanism' and 'faradism' and speak of constant and induced currents, while the physicist, electrical engineer, and biologist on the other hand must not affect a system of peculiarly technical expressions."

Following the president's address came the reports of committees on scientific questions. The report on standard meters, read by Dr. Margaret A. Cleaves, of New York, will especially interest manufacturers because of its conclusions. They were as follows:—

"(1) Meters should be recalibrated once a year. (2) Be constructed to record milliamperes on one scale to a predetermined point and high currents on a second scale. (3) Be ordinarily required to record up to 100 milliamperes. (4) Be placed in the horizontal position. (5) Be flexibly suspended from an isolated support. (6) Be reinforced by a mirror to assist in reading the scale. (7) Be provided with magnetic shade shields when not made with strong permanent magnets. (8) Be capable of indicating either direction of the current, though measuring it in only one direction. (9) Be furnished with reliable binding posts, shunt switches, etc.

Dr. Wm. J. Morton made a report for the Committee on Standard Coils and on Standard Electro-Static or Influence Machines.

Dr. W. J. Herdman, of Ann Arbor, Mich. read a paper on "Constant Current Generators and Controllers." He was followed by Dr. A. Lapthorn Smith, who discussed "Standard Electrodes."

Dr. Cleaves, in a paper on "The Electric Light as a Therapeutic and Diagnostic Agent," said that the electric light has come to do many things for the phsyician as a therapeutic agent. By its use he is able to light up the ear, nose, throat, and other cavities of the body so as to materially assist him in diagnosing or treating cases. The armamentarium of the electric light in therapeutics is already quite a large catalogue. Various devices have been brought forward by the electrical instrument maker and a description of these forms part of this paper. The reader spoke of the great difficulty in getting hold of the proper lamps for experimental work, the society's committee having, after a diligent search, only succeeded in getting a few lamps in order to try some experiments that were suggested. She also referred to the effects of sunlight and electric light on organic life, and spoke of the use of electric heating apparatus as especially adapted to meet the wants of invalids. Plants have been forced into rapid growth by exposure to the rays of the electric light, and d'Arsonval, in a recent study of the subject, observed that the coloration of bacterial growth was markedly influenced by the electric light. It has recently been obserevd that substances which have been submitted to the action of electricity, or which have been exposed to the direct rays of the sun, are in a peculiar state of excitement which renders them much more active as regards one another than are the same substances prepared by the ordinary methods of the laboratory.

One case was cited, of a stenographer suffering from ænemia and aneurisis, who had been materially benefited by an electric arc light bath which was administered for twenty minutes. Dr. Cleaves spoke of the similarity of the effects of sunlight and electric light, and instanced the performances of Nikola Tesla to verify her statements.

Dr. Lucy Hall Brown read a paper on the "Sinusoidal Current Method of Regulating, and the Resulting Current." She also gave a description of some electrodes and exhibited a stand for administering static electricity. Dr. Margaret A. Cleaves exhibited a rheostat for controlling the static induced current. Dr. Robert Newman exhibited a portable battery for electric illumination.

The afternoon session was taken up with a discussion of the constant current. "Direct Current Distribution" was the name of the first paper, read by Mr. W. J. Jenks, of New York. It was an exposition of the effects of direct current distribution upon the human body. The reader took for his text various cases which had come under his observation and the cases of men who have been electrocuted.

Prof. A. E. Dolbear, of Tuft's College, read a paper on "The Physiological Effects of the Constant Current." Prof. Dolbear gave a general exposition of the features of the subject and then touched upon it from the therapeutic standpoint. Concluding his paper he said that since it has been practically demonstrated that what we call a glow lamp is a set of ether waves of electromagnetic origin, it has been apparent to some, although others have not seen the significance of the words, that all atoms are magnets, so that all give electromagnetic waves. Hence, from this assumption, it follows that the living body is but a combination of an enormous number of atomic magnets. It was long ago shown by Faraday that electrical and chemical changes were quantitatively equivalent, and now it is seen that electro-magnetism underlies all chemical action. The significance of it here lies in the thought that in working with electricity to effect physiological changes one is really at work with the fundamental factor of physiological energy, not in a roundabout way but in the most direct way. Functions of all sorts are electromagnetic in the last analysis and he who understands these and the art of properly applying electromagnetic energy to languishing or diseased organs will be able to do all that human skill can do. The more he studied the relation of life to the things on which it depends, the more he is persuaded that though death may be for the benefit of the race it is not necessary for the individual.

"The Therapeutic uses of the Galvanic Current" were discussed by Dr. A. D. Rockwell, and Dr. G. Belton Massey followed with a paper on "The Galvanic Current in Catarrhal Affections." Then came a paper by Dr. Georges Apostolli of Paris, entitled "The Ultimate Result of Conservative Electrical Treatment in Gynæcology," translated by Dr. A. Vedin. Dr. Robert Newman made a report on "The Electric Illumination of Caorities." "Most of the instruments that are used for electrically lighting the human body need improvement" he said. Lieter's cystoscope and the Desmormeaux endoscope he had used with great satisfaction. "The Behavior of Cancer under Mild Galvanic Currents," was the title of a paper read by Dr. R. J. Nunn of Savannah, Ga.

Prof. E. J. Houston and A. E. Kennelly, submitted a paper on "Some Experiments on Death by the Alternating Current." The paper was a protest against the conclusions which d'Arsonval of France has reached regarding the possibilities of the revivification of a person who has been brought under the supposed fatal influence of the alternating current. They endorsed his suggestion that a person shocked by electricity should be treated as a person drowned, but they emphatically call in question the correctness of d'Arsonval's general conclusions in the matter. The particular case mentioned by d'Arsonval contained no marked lesions or evident destruction of tissues, the death was only apparent and resuscitation under the circumstances of course possible. The fact mentioned by d'Arsonval that a pressure of 4,500 volts was on while the subject was shocked, Messrs. Houston and Kennelly think has no significance in the matter unless it is taken in connection with the current passing through the subject under that pressure. "A marked difference exists between the cases of the application of the alternating current as employed in electrocution in New York State, where the current is deliberately continued through the body for the purpose of killing, and such cases of accidental contact as that referred to by d'Arsonval. Assuming the correctness of the ammeter's reading quoted, that is, that a current of only 0.75 was passing, the resist-

ance of the body could not have been less than 6,000 ohms, and the resistance of the body with the electrodes used in the electrocutions in New York, i. e., one on the head and the other on the right calf, is sometimes as low as 200 ohms and usually not more than 300 ohms. The current strength employed is from five to eight amperes, say, from seven to ten times stronger than stated to have passed in the case mentioned."

The writers then detailed a series of experiments in this line which they carried out with the help of some colleagues on a number of dogs in their Philadelphia laboratory. In the case of the dogs it was the unanimous opinion of several medical men present that the death was absolute and restoration impossible in three cases. They believe that the following conclusions may be drawn as the result of these experiments: First; that the passage of a sufficiently powerful alternating current through the body is followed by instantaneous, painless and absolute death. Second; That consequently where electrocution is properly carried out there is no possibility of the resuscitation of the criminal. Third; that in cases of accidental contact where the current passing is not excessive, it is quite possible that death may be apparent only and that the method of artificial respiration suggested by d'Arsonval should be followed.

There was no evening session the first day, the members of the Association attending instead a reception tendered to them by Mr. Nikola Tesla at his laboratory. Mr. Tesla provided a very suitable entertainment by exhibiting some theatrical feats with high frequency currents. A very enjoyable evening was spent by the members.

The second day's programme commenced with the reading of a paper entitled "The Action of Electricity on the Sympathetic" by Dr. A. D. Rockwell. Dr. Rockwell cited various cases to substantiate his remarks.

A paper on "Metallic Electrolysis or Interstitial Electrolysis" was read by Dr. Georges Gauthier. Interstitial electrolysis is accomplished each time we connect the positive pole of a pile of a gramme, Siemens other dynamo with an assailable electrode made in zinc, manganese, iron, aluminum, etc., or when we decompose a solution of potassium iodide. It is a voltaic application that was shown in electro-therapeutics by several workers.

This was followed by a paper on "Electro-Therapeutics as Applied to the Eye" read by Dr. L. A. W. Alleman, Brooklyn, N. Y. The paper concerned the treatment of opthalmic surgery and discussed the therapeutic value of the treatment of the eye by electricity. All the apparatus that is needed for the treatment of the eye in ordinary cases would be a battery of eight or ten cells, a milliampere metre and an electrolysis needle, the battery of course to include a rheostat or any other means of control that the maker may see fit to add to it.

Two papers, one on "Secondary Peripheral Neuritis in a Stilt-Walker," and another on "Electrical Reactions of Muscle and Nerves after Great Exertions in Sport," by Prof. J. Bergourie, of Bordeaux, France, followed. "Notes on Goitre and the Improvements in the Apparatus for the Treatment of Same," was read by Chas. R. Dickson. Speaking of the treatment of goitre by electricity in the hands of the general practitioner, the author said that the possession of proper apparatus and its care, minute acquaintance with fundamental laws, and a proper estimation of the tremendous force of the agent employed, are only a few of the features which militate against the use of electricity in the treatment of goitre, and unless in the most exceptional cases it would be better to leave it severely alone.

The afternoon session was opened by "Electric Sanitation" by Dr. John S. Langley. "The Physics of the Electric Light in Relation to Organized Matter" was next on the programme, followed by a paper on "Hydro-Electric Methods" by Mr. Newman Lawrence, of London. Dr. Margaret A. Cleaves followed with a paper in the same strain on "Special Hydro-Electric Applications." Then came Dr. W. S. Hedley, of Brighton, England, who sent a paper entitled "The Hydro-Electric Therapeutics of the Constant Current." The author chiefly concerned himself with the electric water bath. Directions for treatment were given and the paper concluded with a description of the dimensions and construction of an electrical tub, which he has found very useful in practice. The bath tub should be of oak, ovoid in shape, about four feet ten inches long and two feet six inches in greatest width, which is two inches nearer the head than the foot. There are five fixed electrodes of bright metal covered only by light, open wooden framework. In addition to these there is an electrode for monopolar work consisting of a removable metal rod one inch in diameter, covered by wash leather. This is fixed across the widest part of the bath tub and can be conveniently grasped by the hands. The electrodes are connected by carefully insulated wires with seven terminals, and these in turn lead to a switchboard so arranged that by the insertion of plugs any or all can be brought into action either as anodes or cathodes. The connection with the battery coil of either source of supply is by well insulated connections leading to two ordinary binding posts on the plug switchboard. In the interests of cleanliness the electrodes should be of bright metal, as the neglect of cleanliness is often attended with serious results. Another electrode, is known as the "paddle," which, by means of a long insulated handle can be applied to the vicinity of any part of the body upon which it may be desirable to concentrate the current. The device of placing a partition diaphragm across the bath tub through which the immersed body passes is worthy of trial. It must, in an important degree, influence current diffusion, and if further investigation prove its usefulness it ought to become in the future part of the standard electric water bath.

Prof. Elihu Thomson contributed some "Notes on the Effects of High Frequency Discharges Passed Through the Body." Prof. Thomson said he had been experimenting with alternating currents for a number of years. His early efforts in this direction are contemporaneous with those of d'Arsonval and Tesla. He said that much absurd talk had been made in the newspapers over the ability of persons to withstand hundreds and thousands or even millions of volts. "It is a very old experiment, of course, to insulate a person's body and charge and discharge the same with spark ten inches in length without special inconvenience. A person could be subjected to a charge or discharge at a high frequency, say of 10,000 per second, and with a voltage of 100,000 or 200,000, and yet have a comparative absence of sensation during the reception and reversal of charges." Prof. Thomson stated that he has "never been satisfied with the vague explanations attributing immunity to the skin effects or the flow of high frequency discharges almost wholly on the surface of the conductor instead of through its interior. On the contrary the very nature of the tissues of the body would prevent the skin effect. The outside surface of the arm is fairly dry epidermis which on account of its high resistance would prevent the passage of current and the true dermal layer, though conducting, is of extreme sensibility, so that a concentration of current in the skin should rather enhance pain than annul it. That no condenser effect as such is the cause of the immunity, is proved by the simple consideration that two persons may have each an arm connected respectively to the electrodes of the high frequency apparatus, while if an incandescent lamp is held between them by the other hands so as to complete the circuit of which the lamp is a part, the lamp is lighted, though the actual potential of the source may be so low as to give a circuit having no more than $\frac{1}{12}$th of an inch. The position of the lamp in the circuit forbids condenser action if the potential itself were not too low for such action."

The last paper of the second day was "Some Landmarks in Electro-therapeutics," by Dr. O. S. Phelps, of New York. It was a resume of the advance of electro-therapeutics made in recent years. The immense amount of ground which has been covered while electricity has been passing from the hands of quacks into the hands of the scientist, was gone over by the reader of the paper.

The evening of the second day was devoted to a reception given at the New York Academy of Medicine to the Association by the resident Fellows.

The last day's session was inaugurated by a business meeting, after which "Induction Currents" were discussed. Dr. W. J. Engleman, of St. Louis, took care of the physiological end of the question. Dr. A. D. Rockwell talked on general faradization, while Drs. A. H. Goelet, H. E. Hayd and A. Lapthorn Smith treated the subject from the gynæcological standpoint.

The sinusoidal current was then taken into consideration. Mr. A. E. Kennelly went into the scientific delineation of what the sinusoidal current is. It is a "particular kind of alternating current of which there are countless varieties. It takes its name from the fact that the current strength follows the law of sines as regards its variation in time. The term is synonymous with the term simple harmonic current. Simple harmonic motion is a constant occurrence in mechanics, being met with in fly wheels and engines of nearly every description. Of all possible types of alternating currents the sinusoidal current is the one which has the least mean rate of change and therefore of all possible alternating currents that can be applied to the human body it is the one which possesses, for the frequency considered, the least mean irregularity."

The therapeutic effects of the sinusoidal current were then discussed by Drs. Herdman and Kellogg. The therapeutic uses of it were treated by Drs. Cleaves, Morton, Kellogg, Walker and Goelet.

Then followed a paper on "Alternating Currents; their Transformation and Therapeutic Application," by Drs. Gauthier and Larat of Paris.

Prof. E. J. Houston opened the last afternoon session with a paper on "The Functions of the So-called Static Induced Current." Prof. Houston talked on the static induced current from all standpoints, illustrating his arguments by drawings. He deduced the following practical points of interest. First: The most harmful discharges are obtained when the E. M. F. is high, that is, when the discharging balls are farthest apart; we have seen that this does not alter the frequency but increases the amplitude of oscillations of E. M. F., and therefore the amplitude of current in the circuit, other things being equal. It may happen, however, that the frequency of the sparks at a large air gap may not compensate for the increased current. Second: All unnecessary electrical resistances in the circuit should be eliminated in order to produce the maximum number of oscillations, and such coils employed in order to avoid unnecessary inductance and its depressing effect upon the frequency, should be in the form of loops and not spirals. Third: Where high frequency oscillations are desired, the condenser or condensers in circuit must be small and the inductance small. Fourth: High frequency can therefore only be obtained at the expense of total charge and discharge, for a small condenser will obviously hold less charge than a large condenser at the same E. M. F."

Dr. W. J. Morton then discussed the physiological effects and general therapeutic uses of the current, after which Dr. D. R. Brower, of Chicago, read a paper on "Some Observations on the Use of Static Electricity in the Treatment of Chorea." Dr. Margaret A. Cleaves then talked on the static induced current, and Dr. J. H. Kellogg, of Battle Creek, Mich., ended the session by a paper on "High Frequency Currents Derived from Static Machines as per Method of d'Arsonval."

Friday morning was taken up with a visit to the Edison Laboratory at Llewllyn Park, where the members of the association were entertained by the great scientist.

The officers for the coming year are: President, A. Lapthorn Smith, M. D., Montreal; 1st Vice-President, J. H. Kellogg, M.D., Battle Creek, Mich.; 2nd Vice-President, Chas. R. Dickson, M.D., Toronto, Ont.; Secretary, Emil Henel, M.D., New York; Treasurer, R. J. Nunn, M.D., Savannah, Ga. The next meeting of the association will be held in Toronto, September 1885.

Medical Electrical Nomenclature.

In the September number of the New York "Polyclinic" Messrs. Houston and Kennelly criticise the classification of currents usually employed by medical writers, and based upon former ideas in regard to different varieties of electrical fluids.

The classification now generally made of electric currents as employed for therapeutic purposes, is as follows: 1.—Faradic currents. 2.—Galvanic currents. 3—Galvano-Faradic currents. 4.—Franklinic currents. 5.—Static induced currents. 6.—The static breeze.

The principal objection against the preceding classification of currents as generally employed in electro-therapeutics, lies in the attempt to characterize the current by the source which produces it. This would only be warranted if the electricity produced by any particular apparatus was exclusively generated by that apparatus. As based upon more rational grounds, Messrs. Houston and Kennelly offer the following classification to replace the one referred to:

Continuous currents.....	Uniform (1).....	(Galvanic).
	Pulsatory (2).....	(Some varieties of Galvano-Faradic).
Alternating currents....	Symmetrical.....	Sinusoidal (3).
		Non-sinusoidal (4).
	Dis-symmetrical (5)	(Faradic).
Intermittent currents....	Oscillatory (6).....	(Static induced).
	Non-oscillatory (7)..	(Franklinic).
Convective currents (8)...	.....	(Static breeze).

Here it will be observed that all the different varieties of currents

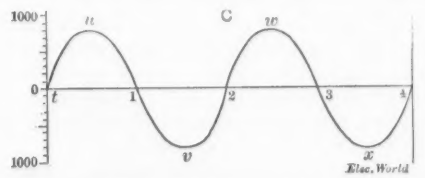


FIG. 2.—DIAGRAM OF SINUSOIDAL ALTERNATING E. M. F'S CAPABLE OF PRODUCING A SINUSOIDAL ALTERNATING CURRENT.

are included under the four main classes of Continuous, Alternating, Intermittent and Convective.

Continuous currents may be uniform or pulsatory. A uniform current is produced by the action of a uniform E. M. F. as that of

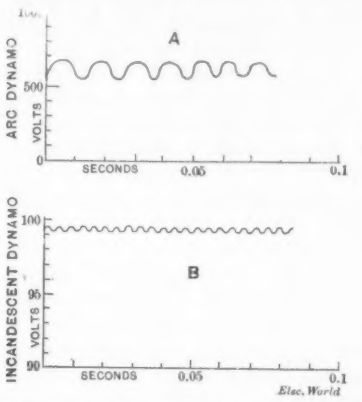


FIG. 1.—DIAGRAMS OF PULSATORY CONTINUOUS E. M. F'S CAPABLE OF PRODUCING PULSATORY CONTINUOUS CURRENTS.

a Leclanche cell or of a thermo couple. Such E. M. F.'s as these would send a uniform current through the human body which corresponds to the galvanic current of the ordinary classification.

The pulsatory current is a variety of continuous current, which,

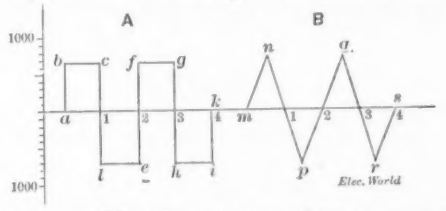


FIG. 3.—DIAGRAM OF NON-SINUSOIDAL ALTERNATING E. M. F'S CAPABLE OF PRODUCING NON-SINUSOIDAL ALTERNATING CURRENTS.

although always flowing in the same direction, is not uniform in strength. The E. M. F.'s of most continuous current dynamos are of this type. Diagrams of pulsatory E. M. F. are shown in Fig. 1, representing the E. M. F.'s produced by arc and incandes-

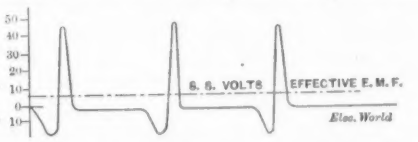


FIG. 4.—DIAGRAM OF DISSYMMETRICAL ALTERNATING E. M. F. PRODUCED BY A FARADIC COIL, CAPABLE OF PRODUCING A DISSYMMETRICAL ALTERNATING CURRENT.

cent dynamos, the pulsations being more marked in the former than in the latter cases. Such pulsatory E. M. F.'s applied to the body would produce pulsatory currents.

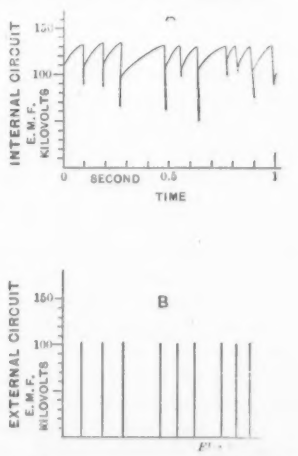


FIG. 5.—DIAGRAM OF INTERMITTENT E. M. F. AS PRODUCED BY FRICTIONAL OR INFLUENCE MACHINES, AND CAPABLE OF PRODUCING EITHER OSCILLATORY OR NON-OSCILLATORY INTERMITTENT CURRENTS ACCORDING TO THE NATURE OF THE DISCHARGING CIRCUITS.

Alternating currents, i. e., currents which periodically reverse their direction, may be either symmetrical, or dis-symmetrical.

Symmetrical alternating currents may be sinusoidal or non-sinusoidal. Fig. 2 shows a diagram of a sinusoidal alternating E. M. F., capable of producing a similar type of current. Fig. 3 shows a similar diagram of non-sinusoidal alternating E. M. F. Voltaic alternating currents are of this type.

The dis-symmetrical alternating current is the type of current produced by all faradic coils under the influence of vibrating contact breaker. Fig. 4 is a diagram of such an E. M. F.

Intermittent currents may be oscillatory or non-oscillatory. An oscillatory current is an alternating current, usually sinusoidal in type, but decaying in amplitude, each wave being of smaller amplitude than the preceding. Oscillatory currents, produced by the discharge of a Leyden jar, correspond to the static-induced currents; they are usually of extremely brief duration, and of very high frequency, a whole series, of perhaps ten oscillations, being completed, in, say, the twenty-thousandth part of a second.

Non-oscillatory intermittent currents are produced by discharges from influence machines through circuits unfavorable to the development of oscillations. E. M. F.'s capable of producing intermittent currents are shown diagramatically in Fig. 5. Franklinic currents are of the non-oscillatory intermittent type.

The convective current, or convective discharge, is produced by the convection of electrified particles of air or other material. To this type belongs the static-breeze.

Notes on the Management of Railway Power Stations.—I.

BY GEORGE T. HANCHETT.

THE BOILER.

As an engineering analogy to the old saying "Charity begins at home" we might say economy begins in the boiler room. We have a poor start in generation of electricity from coal. Thomson has given the law of degradation of energy by saying that, "All energy tends to pass from a higher form to a lower and ultimately to assure the form of uniformly diffused heat." Starting as we do with the very lowest form of energy it is only by the careful effort on the part of man that we shall succeed in raising a goodly percentage of it to that highest form, electrical energy. Heat is the most elusive of all forms of energy to direct and control, and therefore the successful, practical station manager must know how to handle his boiler.

The aim of this series of articles is not to furnish a universal fund of information for the management of power plants, but it is rather to discuss some points of interest, and some practical difficulties which arise, together with hints and remedies which the writer has found useful.

Very few people realize how much coal is wasted by boiler scale. Below is given a table which in a very general way shows the loss of fuel from various thicknesses of scale. It is to be borne in mind, however, that there are many different kinds of scale, and that their heat conducting powers vary very widely.

Thickness of scale in inches.	Loss of fuel in per cent.
1-64	2
1-32	4
1-16	9
1-8	18
3-16	27
1-4	38
3-8	48
1-2	60
5-8	74
3-4	90

From the above it may be seen that even a small thickness of scale is a serious matter, and where the amount of coal used is large the saving would represent so great an interest that it would pay to invest a large principal to avoid the scale. Boiler scale, like everything else, must be battled with systematically. Potatoes or tan bark will not cure your boiler from scaling just because some one else has used them with great success. Boiler scales are different in their nature and chemical composition and a remedy which would be valuable in one case will be worthless or even detrimental in another. There are only a few general rules, which apply in almost every case, and which tend to avoid any kind of scale, and these will be given subsequently.

Boiler scale may be divided into four classes. That which results from

(1) Solid matter held in suspension in the feed water.
(2) Mineral salts soluble in cold water, but not in hot.
(3) Mineral salts soluble in water charged with carbonic acid. This gas is driven off by heat and the salts precipitate.
(4) Mineral salts soluble in both hot and cold water.

The remedies may be applied

1. Before the water enters the boiler.
2. After the water enters the boiler.

The first of these methods is preferable as there is then no chance for a boiler to scale on pure feed water.

Treatment of case (1). Filtering and allowing to stand till the sediment settles is the best method. The water may possibly be treated with chemicals and the case reduced to that of case 4.

Treatment of cases (2) and (3). Use hot feed water and allow it to stand in a settling drum. Neglect of the second caution is the usual cause of scale, as no one uses cold feed water. The aim should be to precipitate the foreign matter as a soft mud in the settling drum where it can be easily removed and not allow it to bake into a hard scale on the boiler, where it requires for its removal a hammer and cold chisel.

For case 4 there is no excuse. The general rules given beyond will entirely prevent it. If the writer had not actually seen such cases and found incrustations of soluble salts in some few neglected boilers he would hesitate before classing this as a source of scale.

The use of chemicals to prevent boiler scale is much misunderstood. Briefly it should be governed as follows: Chemicals should be used before the water enters the boiler with the idea of precipitating all the matter in solution or suspension as a soft mud, as before explained.

After the water has entered the boiler the aim should be exactly the reverse. The chemicals should either unite with the salts and produce a salt that is soluble, and thus reduce to case four, or they should form a flocculent precipitate with the salts that will be held in suspension and not adhere to the sides of the boiler to bake into a hard scale. Care must be taken that the chemicals added are not injurious compounds in themselves or form injurious compounds with the salts in the feed water. It is, therefore, absolutely necessary to know what the composition of the scale is before applying chemicals as a remedy. Corrosion is a worse evil than scale.

Below is given a list of various chemicals and substances used in the prevention of boiler scale and comments on their action and their merits.

Caustic soda. This salt will absorb carbonic acid gas and will thus render the carbonates of lime and magnesia insoluble in the water previously charged with this gas. These latter salts often occur in boiler scale. Lime and carbonate of soda are also useful in this case. Any of these salts must be added in certain definite proportions according to the nature of the feed water and the amount of salt that it contains in solution. To treat water with caustic soda it must be at least of a temperature of 180 degrees F. and with carbonate of soda the water must be at the boiling point. These chemicals are to be used before the water enters the boiler, as they precipitate the obnoxious compounds. Care must be taken to let the precipitate settle or the trouble is made worse. Caustic soda or lime will usually do any work of this nature. Special boiler compounds are to be avoided. The very assumption that such a compound is a universal cure for boiler scale is a sufficient proof that it is worthless. These compounds are also liable to contain injurious substances.

Zinc when introduced into a boiler will sometimes prevent scale, particularly when the scale is sulphate of lime. It forms a precipitate which is held in suspension. It is not effective if the water contains much organic matter, and it must be used cautiously as in some cases it corrodes the boiler.

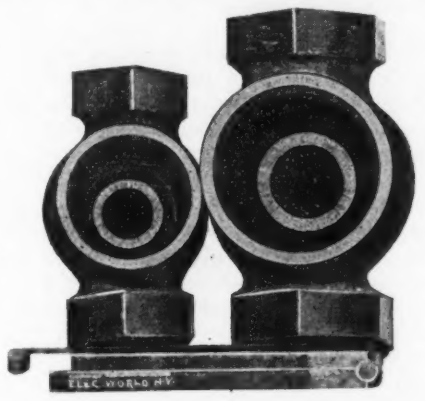
Oil: Too much caution cannot be used in the use of oil in boilers for the prevention of scale. The oil forms a thin coating on the plates and the scale does not adhere and bake on. It is, however, very liable to cause over-heating of the plates and will thus bulge them in a manner that will ruin the boiler. The oil used should be the highest grade of kerosene, and the use of an oil with a body or one that has lubricating properties is fatal to the boiler.

Vegetable substances may be sometimes used with success in cases of water containing salts of lime. They form a precipitate with the latter, which precipitate is held in suspension and does not deposit on the plates. Oak bark, tan bark, and chips are sometimes useful.

In general to avoid scale, heat the feed water and use the settling drum. This will prevent a great deal of foreign matter from entering the boiler. That which does succeed in entering may be reduced by frequent blowing off. If the boiler is blown down to the lower gage cock and then pumped up again the gain will be just the difference in the amounts of solid matter in the quantity of water

blown off and the same bulk of less saturated water pumped in. The boiler should be periodically cleaned out and started with fresh water.

Corrosion of boilers is a most annoying and dangerous evil. It may be either internal or external. Internal corrosion is usually caused by poor feed water or by some remedy(?) for boiler scale. External corrosion is often caused at the contact of the boiler with its setting by moisture on the destructive action of cement. Corrosion frequently results from leaks and the constant evaporation of water on the outside surface. The head of a rivet may be completely removed by corrosion. Boilers should be frequently inspected to detect such rivets. The injured riverts may be temporarily replaced by short bolts of the same size or nearly so, supplemented by heavy well-annealed copper washers. Lead washers may be used with advantage where the rivet holes in question are removed from the influence of fire. In placing such a bolt have the bolt hot and



GROOVED GLOBE VALVE SEATS.

the washer cold. This, together with the fact that copper expands more than iron with a given rise of temperature, will insure a tighter joint. A tight joint is very necessary, as a jet of escaping steam will cut grooves in the neighboring rivet heads, or, in fact, any metal that it strikes, and this in an incredibly short space of time. It will also enlarge the orifice from which it escapes and make matters worse. The cutting of steam valves is a familiar example of this phenomenon. The accompanying illustration shows two specimens of such valves. The necessity of shutting a steam valve tightly is there clearly shown.

Much has been written on "how to fire boilers," and much more might be written. Suffice it to say that no general rules apply to any one boiler. The draught, the type of boiler, and the kind of coal are important considerations. The necessity of a good fireman is most important. The writer will not attempt to enter into a wordy discussion on this matter, but will present the following calculation which will speak for itself. Let us assume coal worth $2.50 per ton and that the fireman has to stoke a 300-hp plant at full load ten hours daily. Assume also 300 working days to the year. A good fireman with a good plant will use three and one-half to four pounds of coal per horse power per hour and a poor fireman may use as high as six pounds. Assuming a saving of one and one-half pounds by the good fireman, the yearly saving is

$$\frac{1\frac{1}{2} \times 300 \times 300 \times 10 \times 2.50}{2,000} = \$1,687.50,$$

an amount sufficient to pay the increase in wages of the good fireman and have a snug sum to spare. The yearly coal bill, assuming a consmption of four pounds per horse power per hour, would be

$$\frac{4 \times 300 \times 300 \times 10 \times 2.50}{2,000} \text{ or } \$4,500.00.$$

Is there a capitalist who would seriously think of allowing a $1.50 per day man to invest $4,500.00 for him yearly? And yet that is precisely what some are doing. The coal is just as truly wealth even if it be as cumbersome as the iron money of Lycurgus.

(To be continued).

The Attractiveness of Alternating Current Distribution.

Our London contemporary, the "Electrician," which has not been the most friendly journal toward the alternating current systems, makes the following remark: "If the general public were allowed to become familiar with all the practical details of alternate current distribution, all the mystery, and, therefore, half the attractiveness of that system would be gone."

Electrodynamic Machinery—X.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

47. We will now proceed to study the phenomena which occur when iron is introduced into a magnetic circuit. Suppose, for example, a closed circular coil in Fig. 44. We have seen that if this ring be excited with 800 ampere turns, or 1005.6 gilberts, the flux through the ring will be 167.6 webers, or, since the cross section of the ring is ten square centimetres, the intensity will be $\frac{167.6}{10} = 16.76$ gausses, and this intensity would remain practically unchanged if the substance of the ring were copper, brass, lead, zinc, wood, glass, etc. When the ring is made of iron or steel, a very marked change takes place, the flux instead of being 167.6 webers, becomes, say 170,000 webers, with a corresponding increase in intensity. This increase of flux in the circuit must either be due to an increase in the M.M.F., or to a diminution in the reluctance. It is usual to consider that iron conducts magnetic flux better than air; or, in other words, has a greater permeability than air. This idea corresponds to a reduction of reluctance similar to the reduction of resistance in an electric circuit. Although generally accepted, this conception is manifestly incorrect; for if the increased flux due to the presence of iron in the ring disappeared immediately on the removal of the M.M.F., then there would be no preponderance of evidence in favor of either hypothesis. But the magnetic flux does not entirely disappear on the cessation of the prime M. M. F. On the contrary, in the case of a closed iron ring, the greater portion of the flux remains in the

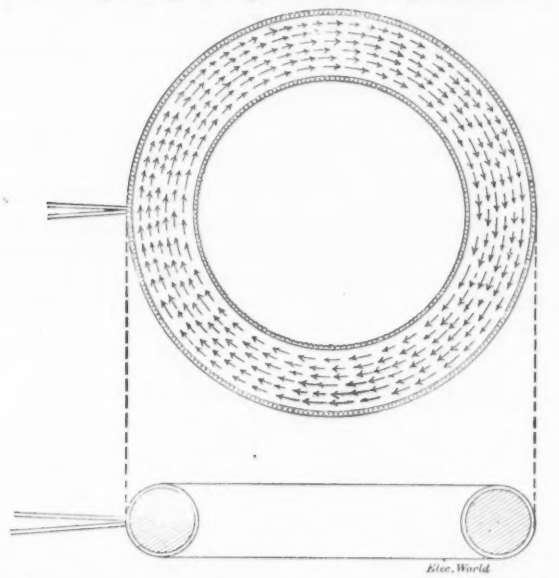


FIG. 44.—SECTIONS OF WOODEN RING UNIFORMALLY WRAPPED WITH INSULATED WIRE CARRYING A CURRENT.

form of what is ordinarily called *residual magnetism.*

48. It is evident, therefore, since the M.M.F. is necessary to maintain the residual magnetic flux in the iron, that this M.M.F. is the cause of the increase in magetnic flux when the prime M.M.F. is applied, and that, therefore, the increased flux cannot be due, except, perhaps, in a very small degree to a change in the reluctivity of the medium, but is due to the establishment of a M.M.F. in the iron itself under the influence of the magnetizing flux. It is now almost certain that the ultimate particles of the iron, possibly the molecules, or the atoms, are all initially magnets; i. e., inherently possess M.M.F.'s and magnetic circuits. The origin of this molecular magnetism in iron is, however, not yet known. In the natural condition, all the separate magnets of which iron is composed, are distributed indifferently in all directions, so that their circuits neutralize each other and produce no appreciable external effects. Under the influence of a magnetizing flux, these molecular magnets tend to become aligned, and to break up their original groupings. As they become aligned, and their M.M.F.'s become similarly directed, they are placed in series, and their effects are cumulative, so that they exercise an increasing external influence, and an extending external flux. Or, taking the hydraulic analogue already referred to, and regarding each separate molecular magnet as a minute ether pump, as all the ether pumps are brought into line, the streams they are able to direct are increased in velocity, and are, therefore, carried further into the surrounding space. Consequently the flux

produced in the magnetic ring shown in Fig. 44 when furnished with an iron core, may be regarded as arising from two distinct sources of M.M.F., namely:

(1) The prime M.M.F., or that due to the magnetizing current which produces the flux through the circuit and substance of the iron, the value of which is practically the same as though the core were of wood or other non-magnetic material. This flux may be called the prime flux and possesses a corresponding prime intensity. In the case considered the prime intensity or magnetizing flux is 16.76 gausses. This magnetic intensity, acting upon the molecules of the iron, produces:

(2) The induced M.M.F., which may be called the aligned or structural M.M.F., and depends for its magnitude not only upon the quality of the iron, but also upon the intensity of the prime flux. The harder the iron, and the greater its mechanical tendency to resist distortion, the greater must be the prime intensity or the magnetic distorting power, in order to bring about the full structural M.M.F. When the prime intensity has reached such a magnitude that all the separate molecular magnets in the iron are similarly aligned, the iron is said to be saturated, and the M.M.F. it produces is a maximum, and on the removal of the prime M.M.F. the structural M.M.F. will, in the case of a closed ring, largely remain, especially if the ring be of hard iron or steel. If, on the contrary, the ring be of soft iron, and have an air-gap cut in it, the structural M.M.F. may largely disappear. The relation between the structural M.M.F. and its flux, and the prime M.M.F. and the intensity which produces it, is complex and can only be ascertained by experimental observation.

49. Fig. 45 represents the same iron ring with a saw-cut or air-gap at A, having a width of 0.5 cm. The reluctance of this air-gap, which neglecting diffusion, has a length of 0.5 cm and a cross-section of 10 sq. cms. is $\frac{0.5}{10} = 0.05$ oersted. If the total structural M.M.F., established in the ring under excitation, be 180,000 gilberts, then immediately on the withdrawal of the prime M.M.F., the residual flux through the circuit will be $\frac{180,000}{6} = 30,000$ webers. Where this flux passes through the reluctance of the air-gap there will be established a *counter M. M. F.*, just as in the electric circuit where a current of I amperes passes through a resistance R there is established a *counter E. M. F.* of IR volts. So that the counter M.M.F.

Elec World

FIG. 45.—IRON RING PROVIDED WITH AIR-GAP, AND WOUND WITH WIRE.

has in this case the value, $\mathfrak{F} = \Phi \mathfrak{R}$ $30,000 \times 0.05 = 1,500$ gilberts. This counter M.M.F. represents a mean demagnetizing force of $\frac{1,500}{60} = 25$ gausses, through the iron circuit. If this intensity of demagnetizing force is sufficient to disrupt the structural alignment of the molecular magnets, the residual magnetism will disappear. If, however, the intensity be less than that which the hardness of the iron requires to break up its structure, the residual magnetism will be semi-permanent.

Even though it be admitted that the preceding represents the true condition of affairs, and though it is the only existing hypothesis by which the phenomena of residual magnetism can be accounted for, nevertheless, for practical computations connected with dynamo machinery, it is more convenient to assume that there is no structural M.M.F. in iron, and that the difference in the amount of flux produced in ferric circuits is a consequence of decreased reluctance in the iron, or, in other words, that iron is a better conductor of magnetism, and we will, therefore, in future, adopt the untrue but convenient hypothesis.

(To be continued).

How to Make a Voltmeter and Ammeter.—For Amateurs—II.

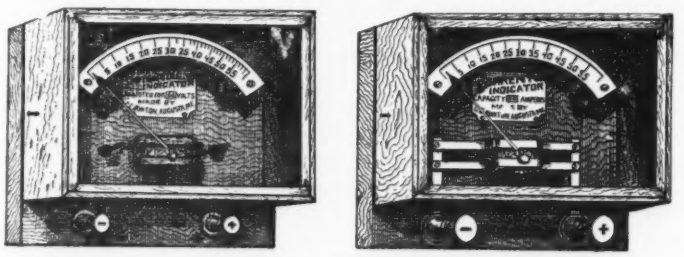
BY G. E. DUNTON.

We will bring the current in at the right hand binding post, as it will be more convenient, and the direction in which the needle will swing is given in Orestedt's law, which is as follows:

"A current of electricity, passing or flowing (so termed) in a wire, from left to right, over and back under, will cause a needle, suspended with its length in a plane with the direction of the current, to deflect or swing to the right, until it reaches a point at right angles to this plane, where it becomes set as long as the specific force of the current is maintained. A current flowing from right to left, over and back under, will cause the needle to swing to the left."

Bearing these facts in mind, we will begin to wind. A wooden arbor should be fitted to the hole through the core, and, with a dog on the face-plate end, placed between the lathe centres. The wire should be on a spool and placed over a spindle of some kind, so it will turn freely. Begin in the coil space next to the face plate, or at the left hand, put the end of the wire through the fibre plug in the inside collar, draw through three or four inches of the wire, coiling it around a common lead pencil into a tight helix to keep it out of the way. Now begin to wind slowly, turning the lathe backwards, which should be done by hand for a coil of this shape. As each layer is wound in, give it a good coat of insulac before the next is wound on over the top of it. The winding should end on the rear side next to the middle washer. Leave an end of about eight inches coiled into a helix. Tie it where it leaves the coil with fine thread to the next strand, this keeping it from unwinding. A little trick, which it may be worth while for the amateur to know, is as follows: Before the last layer or coil has been wound on, and when we have reached the last turn of the layer preceding it, cut the cotton-covered wire, splice on and solder some double silk-covered wire of the same size, letting the splice come on the rear side of the coil. Wrap a thickness of stiff brown paper around the coil and wind on the last layer over it

When the other coil is wound in, turn the arbor around, bringing



THE COMPLETED INSTRUMENTS.

the coil space next to the face plate, and proceed in exactly the same manner; the inside ends coming through the fibre plugs should be scraped free of insulation, twisted together, soldered and the surplus end snipped off. The two outside ends go through the fibre posts in the back of the case, through the back, to their respective binding posts. The wire should be covered with soft rubber tubes and run in grooves cut in the under side of the back, from the fibre posts to the binding posts. In going from the core to the fibre posts, leave about a dozen turns of the helix in the end wire, opening it out some; this looks more finished than a straight length of wire would.

This instrument is wound for a potential not exceeding 60 volts. If desired to measure a higher potential, use a proportionately finer wire, or put in more resistance, as stated. Each coil space holds 22 layers of wires of 22 turns each, making 968 turns of wire in both coils. Before the ends are connected to the binding posts, the needles should be put in place, the spindle inserted, the pointer put on, the hangers screwed in place and the armature movement adjusted carefully, and the whole screwed to the back of the case, the scale being placed in position and nicely adjusted, so that the pointer will swing evenly over it. The markings on the scales had better be done in India ink, so that it can be readily changed if desired. It is a good plan to paint the needles, say the right hand half red and the left black, so that if ever taken out they will be returned in the same position. If you are fortunate in having some friend in a lighting station, and can secure his permission to put your meter on beside the station instruments, the calibration can be

easily and accurately done. The swing of the pointer may be governed by the size of the balance weight; if it doesn't swing quite far enough, trim off a little from the weight. All future adjustments should be with the thumb nut. The first adjustment should be made with the nut way out to the end of the screw. See section No. 4. If the builder desires, he may substitute two incandescent lamps in series for the German silver wire, and re ulate it by different voltage lamps. In a meter the writer has just completed two 59 volt lamps, in series, furnish the necessary resistance. The meter coils are in multiple or parallel, and there is not as much heat.

The winding of the ammeter is entirely different. For the winding, four strips of sheet copper are needed, 4 feet long, 7-16 of an inch wide and 1-64 thick. In insulating the core, use the same kind of leather-board washers, and also one of mica, placed between this and the brass collar on each end. Wrap a thickness of mica around the core, with one thickness of asbestos paper around this, and lay two thicknesses of the copper together; this will constitute a layer in winding. Mark off a point about 6 inches from the end and bend the ends over across the strip in the form of a square, as shown in Fig. 15A. Now carry the ends up by the side of the strips, Fig. 15B. The purpose of doing this will become apparent by laying the copper in position in the coil space; while the copper lies flat on the core, the end will come out by the succeeding layers to be laid on, fitting nicely into the recess pressed into the middle brass collar. After the copper has been carried once around the core, and before it is passed over itself, a strip of mica and asbestos paper must be carefully laid in and carried out between the succeeding layers as we continue to wind. A piece of the leather board and mica must be slipped in between the coil and the end coming out at the side.

The winding is carried in exactly the same direction as in the voltmeter. Both coils should end on the rear side, looking at the front; the finishing end of the upper coil will be on the right hand side, while that of the lower coil will be on the left. The beginning ends of the coils may be bent down and across their respective coils, and the ends again turned over themselves at right angles and coming out in the opposite direction from the finishing end of the respective coil. Great care must be used in insulating; wherever this end crosses the other layers and where it bends over the last layer the insulation must be perfect. This method of winding gives us two parallel circuits, having a safe carrying capacity for a current of 100 amperes, though the model is adjusted for only 60. Two copper bars, ½ inch wide, ¼ inch thick and about 6 inches long, are sunk into the back of the case, with asbestos paper between the metal and the wood. They are drilled and tapped for the screws holding the ends of the copper strips at their upper ends, while the lower ends carry the binding posts on the outside of the case. The needles, spindle and pointer may be put in place, the instrument set up and final connections made.

The builder will be fortunate indeed if he can find a chance to place this meter in circuit beside some standard ammeter and calibrate it, but the adjustment and calibration may be accomplished very nicely by using incandescent lamps of a known efficiency; knowing the watts per lamp and voltage, the current each one takes is readily calculated by the following simple formula: Watts ÷ voltage = the current. For the adjustment, turn on all the lamps the dynamo carries and adjust the weight so the pointer will swing as far over the scale as desired. In calibrating, turn them all off, and then turn on one at a time, noting and carefully marking each degree the pointer advances as the lamps are turned on. Try this several times, changing the order of turning on the lamps each time, and carefully note whether or not any variation occurs. If it does, provision must be made for it; if not, the scale may be nicely numbered and the meter is complete. This same core may be wound with wire for a small current, as in arc lighting, using double or triple cotton-covered No. 12 B. & S. gauge copper wire, with the two coils connected in series. The entire success of both these instruments depends wholly upon careful, painstaking construction. The ammeter is in series with the dynamo; that is, the whole current passes through its coils. The voltmeter is in parallel to, or in multiple with it, only a very small portion of the whole current therefore passing through its coils, but it receives the whole pressure of the current. In sending a current through the coils of either of these instruments for the first time, swing the pointer over as far as it goes to the right, *before* the current is turned on; hold it there for a few moments and let the current circulate through the coils; this insures correct polarity. Should the needles refuse to take the respective poles as we desire, take them off the spindle and reverse the ends.

The Convention of the American Street Railway Association.

The secretary of the American Street Railway Association officially announces that the thirteenth annual meeting of the Association will be held in Machinery Hall, Piedmont Park, Atlanta, Ga., October 17, 1894, commencing at 10 o'clock, A. M., and continuing three days. The following is a general programme of the meeting: Reports of special committees will be made on: "A Standard Form for Street-Railway Accounts;" "Can the T Rail be Satisfactorily Used in Paved Streets;" "City and Suburban Electric Railways;" "Mail, Express and Freight Service on Street Railway Cars;" Standards for Electric Street Railways;" "Street Car Wheels and Axles;" "The Best Method of Treating Accidents and Complaints;" "The T Rail Construction of the Terre Haute Street Railway Company," and "Transfers and Commutation." Special papers will be read on the following subjects: "A Practical System of Long Distance Electric Railway Work;" "Brake Shoes;" and "Destructive Arcing of 500 Volt Fuses."

An exhibition of supplies of every nature used in the street-railway business will be held in Machinery Hall. The building has been engaged for two entire weeks, beginning October 10th., and ending October 24th, thereby giving ample time for the setting up and removal of the largest exhibits. The exposition will be in charge of the Secretary, assisted by Mr. N. W. L. Brown, of the Atlanta Consolidated Street Railway Company. Applications for space, if not already made, should be sent without delay direct to Mr. Brown, at Atlanta.

The Atlanta Consolidated Street Railway Company proposes to entertain all who attend the meeting with an excursion. A typical "Georgia Barbecue" will be a prominent feature of the occasion. All the Traffic Associations, except the Western Passenger Association, have authorized the sale of tickets at a fare and one-third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. The attendance of the wives and daughters of gentlemen attending the convention has become an established custom, and the ladies will be entertained Wednesday evening at the Capital City Club. The annual dinner will take place in Thursday evening, October 18. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies tickets, will be five dollars each.

Sine Form of Curves of Alternating E. M. F.

To the Editor of The Electrical World:

Sir:—I have read with interest this week's addition to the somewhat fruitless discussion of the best form of wave in alternators. I regret that the accomplished Editor of the London *Electrician* should have had recourse to "secular polemics" in what should be purely a calm and scientific discussion.

As you may judge from my previous letter upon this subject, I am in substantial accord with him on the irrelevance of the extreme claims made for the sine wave by "the manufacturers in America" to whom he refers; nevertheless it seems to me that the discussion has degenerated into a squabble and has been full of mutual misunderstandings.

In the first place, there has been scanty recognition of the very wide difference in conditions when we consider static transformers and rotary field motors. What is true of the former is only true of the latter in so far as the induction motor may be regarded simply as a transformer without reference to its motor function. If Fourier's theorem means anything in relation to the question under discussion, it means that in the case of a non-sinusoidal wave we may consider it to be built up of a single fundamental wave plus a series of other sinusoidal waves. These latter, from physical reasons, we recognize as harmonics of odd order. When, therefore, we are dealing with a non-sinusoidal wave of a given frequency, we must recognize the fact that of the total energy of the wave a portion is at the virtual frequency F and other portions at frequencies $3F$, $5F$, etc. When such a wave is used in a transformer having an iron core, the effect is precisely the same as if we were dealing with a sinusoidal wave having a certain other frequency F' greater than F. It is, therefore, to be anticipated that, providing the conditions are such that we can utilize these higher harmonics, transformation can be effected with a less core-less. This only restates the familiar fact that with a transformer designed for a particular frequency, a greater output at substantially the same loss can be obtained by increasing the frequency within, of course, reasonable limits. There is not the slightest reason, either mathematical or practical, to suppose that in any given case any better results would be obtained

from using a wave consisting of an indefinite number of harmonics than from a sinusoidal one of equivalent frequency, as regards magnetization. As M. Blondel has very justly stated, the sinusoidal wave would have the advantage in the matter of convenience, because of the greater certainty with which static and inductive effects can be predicted.

The equivalent frequency F' not being the same for all conditions of the external circuit, as M. Blondel suggests, there is an added convenience in employing the sine wave rather than a mixed one. So far as static tranformation goes, the non-sinusoidal wave is merely an indifferent method of raising frequency, possessing certain inconveniences and no particular compensating advantages; for as Mr. Steinmetz has very justly pointed out, it is quite easy to produce very close approximations to the sine wave in a properly designed iron clad alternator.

As regards induction motors the case is decidedly different. While the mere action of transformation accomplished in such motors will follow the same general rule above stated with reference to static transformers, it is quite certain that rotary poles of the higher orders are of little or no use in the operation of the motor, and the higher harmonics only tend to disturb the proper functions of the apparatus by increasing parasitic currents, adding to the inductance of both primary and secondary circuits and the like. In general, the worse the motor the more will these variations interfere with its proper action. If it is properly designed, its motor functions will be seriously disturbed only by quite great disturbing harmonics. This corresponds with the results found by both Mr. Steinmetz and myself.

It should be noted here that the case in which Mr. Steinmetz found 13 per cent. advantage in using a distorted wave was not, as the Editor of the *Electrician* states, in a motor, but in a static transformer, and furthermore, one of low frequency type, in which the saturation was comparatively high.

Going back to our idea of an equivalent frequency, we must recognize the fact that in motors the speed is determined by the fundamental; consequently when a widely non-sinusoidal wave is used, a portion of the energy is relatively ineffective, while with the sine wave of equivalent frequency, the speed of the motor would correspond with the total energy. Of the bad effects of non-sinusoidal wave in motors of this class there can be absolutely no question so far as the fact itself is concerned, as is amply shown by the experiments of the various parties to this discussion.

With various waves the energy represented by the harmonics may be more or less in effect, but can never be entirely helpful or quite unobjectionable. It is, however, sufficiently obvious that for moderate variations from the sine form and for well designed motors, the effect is negligible.

So far as the line is concerned, higher harmonics are bad in proportion to their amount. A wave containing them is worse than the sine wave of equivalent frequency in its static relations and with respect to resonance, in which of course the upper harmonics, if of appreciable amount, are particularly objectionable. Experimentally we cannot speak with the same certainty about a line as about an induction motor, but while small variations would probably prove to be more unobjectionable, large ones might be serious, and in any event are quite useless and unnecessary.

Chicago, Ill. Louis Bell.

The following letter by J. A. Fleming on the subject of the sine form of curves of alternating E. M. F. appeared in the London *Electrician* of September 7th:

I only lately became repossessed of my weekly copy of The *Electrician* and read the letters and editorials on the above subject. Broadly speaking, all the evidence I have before me, deduced from a very extensive series of tests on transformers, which have been made on different types of alternators grouped in various ways, leads to a conclusion which is identical with the position taken up by Mr. Steinmetz. If one and the same transformer is tested at the same mean-square primary pressure off alternators of different types, the iron loss in the transformer at no load is found to vary. Taking, for instance, a particular type of transformer, I found that when tested for iron loss on an alternator having a drum armature, with iron core of the type of Westinghouse or Thomson-Houston, the iron loss is less by some 10 per cent. than when tested on an alternator having a copper strip iron-less armature of the type of the Mordey or Ferranti armatures.

It must, however, be borne in mind that the form of the electromotive force curve of an alternator, when determined by an electrostatic voltmeter and contact breaker—the alternator being taken alone and on open-circuit—is not necessarily or always identical with the form of the curve of potential difference between the primary terminals of a transformer worked off that alternator. It is, of course, the form of this last curve which it is important to know. I find, also, that the power factor of a transformer at no load is less when the transformer is tested at the same mean-square primary pressure off an iron-clad or iron-cored armature of the drum-type, than when tested off a strip iron-less armature; but that the apparent power taken up in both cases is about the same. Coming, then, to one question at issue, viz., the form of electromotive force curve which the alternator should possess in order that the iron losses of transformers worked off it should be a minimum. This is a question which can only be settled by an experimental comparison of the no-load losses of transformers tested off alternators of which the E. M. F. curve is at the same time ascertained. Inorder to do this when the alternator is at a distant place, some means must be obtained of driving a revolving contact breaker at a definite speed relatively to the alternator. This, I find can be done by putting the contact breaker on the shaft of a small synchronizing alternate-current motor, which runs in step with the distant alternator, and enables the instantaneous curve of potential difference between the primary mains to be ascertained. By the employment of this device I expect to be able to place against one another the results of a series of tests in which the iron losses of the transformer are compared with the form of the curves of the primary potential difference applied to its terminals. Until these experiments are complete it is impossible to state positively that the E. M. F. sine-curve is the best or the worst form for minimizing the iron core losses of transformers. Up to the present it has certainly not been shown that it is the best. J. A. Fleming.

London, Eng.

In a letter of Prof. Fessenden in this column last week the saving of the energy through reduced hysteresis in the case of the curve of the London *Electrician*, by a printer's error was made to read 15 per cent., instead of, .15 per cent., as written. At the end of the fifth paragraph instead of the ratio of amplitudes being 1.7 as printed it should read 1:7. In an editorial in the issue dated September 22 it was stated that Prof. Fessenden held the opinion that peaked curves have no advantage over sine curves as regards hysteresis, whereas in the letter there referred to he states the reverse, with the qualification that the advantage was slight and more than counterbalanced by other losses peculiar to the peaked curve.

How to Make a Dynamo Excite Itself.

To the Editor of The Electrical World:.

Sir: In reading Mr. Hanchett's article in The Electrical World of Sept. 15th an experience of my own was called to mind which may be of interest. I was installing a new 200-volt compound generator, a counterpart of which was in operation driving a traveling crane and 12 arc lamps, four in series. My assistant while working at the switchboard carelessly disconnected one of the rheostat wires of the running machine causing a bad arc, after which it was discovered that the field had lost its magnetism. The brush connections could not be changed as that would have reversed the arc lamp craters, so the magnetism was coaxed back by throwing on one of the motors and applying "a touching" short circuit at the brushes, relying upon the series winding to build up. It required about ten minutes to get the machine back to normal.

McKeesport, Pa. E. G. Miller.

Cost of Producing Electrical Energy.

To the Editor of The Electrical World:

Sir: Your issue of September 8th contained a leter from Mr. Max Meyer in which he stated that he should have been credited with the information concerning the German central stations mentioned in my paper read before the Northwestern Electrical Association at St. Paul, instead of Mr. J. Laffargue whom I mentioned as the author of it. The figures I gave were taken from the London *Electrical Review* which quotes them from *L'Industrie Electrique* over Mr. Laffargue's signature, stating that it was copied from the *Elektrotechnische Zeitschrift* The editor of the *Review* in a foot-note states that this information was compiled from various sources and corroborated by the managers of some of the central stations. I do not find mention of Mr. Meyer's name anywhere, although I have not seen copies of the other foreign papers. Had I known that he was the author of the figures I certainly would have given him credit for them. B. J. Arnold.

Chicago.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM PRINCIPAL FOREIGN ELECTRICAL JOURNALS

BY CARL HERING

ELECTRO-PHYSICS.

Light from Electrical Oscillations.—A paper by Mr. Ebert from the "Wied. Ann," vol. 53, p. 144, on electrical oscillations of long duration, and their action, is abstracted in the "Elek. Zeit.," September 13. To produce light effects by means of electric oscillations or high frequency currents, the primary and secondary circuits must be so proportioned that the duration of an oscillation for both is equal to $T = 2\pi\sqrt{LC}$, in which L is the self-inductance and C the capacity of the condenser; these values of T should be the same for both, or else have a simple harmonic relation; air and oil condensers are therefore preferable to those with solid dielectrics; to diminish the damping, the condensers should have as small a capacity as possible, and for a given resistance of the circuit there should be as high a self-induction as possible, although with such high frequencies as ten to the seventh power, the self-induction is somewhat limited in order that the apparent resistance should not become too great; the ohmic resistance is negligible. He constructed an apparatus on the Lecher principle, which was proportioned as mentioned above and which showed itself as being very effective for the generation of light. He describes a lamp consisting of a glass bulb containing paste of a greenish blue luminous paint on a glass tube inserted in the bulb; on the outside of the bulb and symmetrical to the paste of paint, were two rings of tinfoil with contact wires to which the circuit was connected; cathode rays perpendicular to the bulb were produced and were almost invisible, but on the surface of the luminous paint a bright phosphorescent light was produced; the candle-power was estimated as one-fortieth to one-thirtieth of a candle, the consumption of energy being extremely small; he estimates it as about 1,500 to 2,000 times as small as in the amylacetate standard candle lamp; the light is a mixture of greenish blue and yellow, and if the yellow could be obtained by itself the light would be like that from a gas or petroleum lamp. He believes it possible in this way to construct bright lights which consume only some millionths of a watt; these high frequency currents cannot be sent along lines and must therefore be generated in a small apparatus close to the lamp.

Oscillations.—A paper by Mr. Righi on electrical oscillations of small wave length and their reflection from metals, is published in abstract in "L'Eclairage Elec.," September 15 (vol. 1, No. 1).

Reflection and Resonance from Hertzian Oscillations.—A paper by Mr. Zehnder from the "Wied. Ann.," vol. 49, p. 724 (July, 1893), is abstracted in "L'Eclairage Elec.," September 15 (vol. 1, No. 1).

Propagation of Electric and Magnetic Perturbations.—A mathematical article by Mr. Blondin is begun in "L'Eclairage Elec.," September 15 (vol. 1, No. 1); he proposes to give a resume and the present state of the subject.

Measurements with Electrical Radiation.—A paper by Mr. Zehnder from the "Wied. Ann.," vol. 53, p. 152, is abstracted briefly in the "Elek. Zeit.," September 13; he speaks of the production of an electric spectrum in which a series of different wave length are produced.

Action of Alternating Currents on Dielectrics.—Mr. Addenbrooke in the Lond. "Elec. Rev.," September 14, discusses Professor S. P. Thompson's recent statement that alternating currents have less action on dielectrics than continuous currents have for equivalent mean pressures. He states that as far as he is aware there is no experimental evidence at present to show that the influence of equivalent alternating currents on dielectrics is greater than continuous, or that they have any greater penetrative power as long as the current is nearly a sine curve, and that there are in fact several directly negative facts to such assertions which were pointed out by him several years ago. The sparking distance is greater for a continuous current than for an alternating; he shows that a dielectric will not take its full strain until after a considerable time, measured by several minutes, and that for an alternating current of say, 100 periods, the maximum period only lasts a portion of the phase, the period of voltage above the mean not lasting more than one-six hundredth of a second. He believes that there is no evidence that an alternating current disintegrates the material, although it seems not altogether impossible. He thinks that the sparking in the electrostatic voltmeter at 20,000 volts was probably due to a resonance effect. A badly constructed alternator may give an extraordinarily high maximum for a short portion of its period, in which case it is quite possible that the effect on dielectrics will be more deleterious than with a continuous current.

Movement of Dielectric Bodies in Electrostatic Fields.—The paper of Messrs. Graetz & Fromm from the "Wied. Ann.," vol. 53, p. 85, is abstracted in the "Elek. Zeit.," September 13; a French translation is published in "L'Eclairage Elec.," September 15. They show that contrary to theory a dielectric body will take up a definite direction parallel to the direction of the lines of force in an electrostatic field; an instrument based on this principle was tested and it was found that not only can voltages from 4,700 to 15,300 be measured with ease, but also those of alternating currents of 60 volts; they found that the torque is proportional to the square of the difference of potential. They conclude that contrary to theory it must now be accepted that dielectrics consist of conducting particles surrounded by a non-conducting material, and that they have mutual action on each other.

Magnetic Dielectric.—The Lond. "Elec. Rev.," September 14, recommends a paper by Mr. Birkeland in the "Comptes Rendus," vol. 118, p. 1320, describing experiments which seem to promise that more extensive researches would result in more important discoveries.

Rise of Current in Inductive Circuits.—The Lond. "Elec.," September 14, contains an interesting article by Mr. Russell, in which he discusses, by means of diagrams and very simple mathematical deductions, some theorems connected with the rise of current in an inductive circuit and in branch circuits; he discusses the currents in two mutually inductive circuits, first when one is insulated and short-circuited, and then when both are connected in parallel, giving the current curves in each case. He shows, for instance, that on closing a main circuit which branches off in various inductive paths, there may be produced a reversal of current in some of the branch circuits, and on breaking the main circuit there may be a reversal of current in other of the branch circuits; he considers only the case of two circuits, and states that the facts are very well illustrated by connecting the two coils of an ordinary transformer in parallel and then sending a direct current through them; a galvanometer in series with the high tension circuit first showed a momentary deflection in one direction and then a steady deflection in the other, showing a reversed current in that circuit. He states that it is very easy to devise some very interesting lecture room experiments, showing how, by increasing the resistance of one branch, the reversal of the current can be made to vanish in that branch and take place in the other.

Coefficient of Self-Induction.—The paper by Mr. Guye, mentioned in the Digest, September 15, is contained somewhat more fully in "L'Eclairage Elec.," September 15 (vol. 1, No. 1). The same issue contains another paper by that author on the coefficient of self-induction of N parallel and equi-distant wires of which the sections lie around the circumference of a circle.

Resistance of Solutions Under Pressure.—The Lond. "Elec.," September 14, abstracts briefly from the "Wiener Berichte" for May, results of the researches of Mr. Piesch to determine the effect of pressure on the electrical resistance of solutions; the resistance and polarization were determined simultaneously and pressures up to 600 atmospheres were used; the results were as follows: A change of pressure produced a change of resistance, which decreased in all cases with an increase in the pressure; as the pressure increased the decreases of resistance were less; polarization also showed a change of value with higher pressure, but it is small; an increase of polarization with the pressure was in general observed.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Weston Standard Cadmium Cell.—The "Elek. Zeit.," September 13, contains a long and very interesting article by Drs. Yeager and Wachsmuth, being a contribution from the Imperial Technical Institute of Germany. It gives the results in considerable detail of a very complete series of tests made with this cell in order to compare its properties with those of the Clark cell. The article is well worth the attention of those interested in standard cells, as the tests are probably the most thorough and complete that have yet been made and published. The Weston cell is similar to the Clark, only that in place of the zinc amalgam and zinc sulphate the corresponding cadium compounds are used A description of the cell and the way in which it is made is given. From researches to determine the temperature coefficient they find the following formula for values between 0° and 26°:

$$E_t = E_o - 1.25 \times 10^{-5}\, t - 0.065 \times 10^{-5}\, t^2$$

The formula for the Clark cell for 10° to 30° is:

$$E_t = E_{15} - 116 \times 10^{-5}\,(t - 15) - 1 \times 10^{-5}\,(t - 15)^2$$

They find that the difference between the observed and the calculated values are only very slight, being at most 0.00003 volts; a great advantage lies in the fact that they do not change in the slightest degree after repeated heating and cooling; a comparison with the temperature co-

efficient of the Clark cell, given in a table, shows that at 20° C the Weston cell changes only one twenty-third as much as the Clark; in practice, therefore, the temperature coefficient of that cell need not be considered at all; even in precise measurements only an approximate measurement of the temperature is necessary, and the use of petroleum baths and thermostats is therefore unnecessary. The ingredients, their preparation and impurities, are discussed; it was found that a really saturated solution of cadium sulphate can be obtained only after the salt has been left in the water for some time. Regarding the constancy they found that during the four months covering the period of the test the cells were constant to within one-hundred thousandth part of a volt; but they have a great advantage over the Clark cell in that newly made cells have the same E. M. F. as those which are several months old, while Clark cells arrive at their final value only after several weeks. To test their capability of being transported, two cells were sent by mail from Berlin to Frankfort and back, packed so that at least one of the two was always upside down; subsequent tests showed that the cells did not change during this transportation; an approximate determination of the E. M. F. gave 1.025 legal volts. Their conclusions are that the Weston and Clark cells are equally constant and can be equally well reproduced, but the Weston has the following advantages: its E. M. F. arrives at its definite value immediately after it is set up; the E. M. F. follows changes of temperature very rapidly; the temperature coefficient is so small that the use of petroleum baths and thermostats are unnecessary and an approximate determination of the temperature is sufficient; special care need to be taken only in the preparation of the cadium sulphate in which absolute neutrality and complete saturation are necessary.

(In connection with the above the following information, received by the compiler from Mr. Weston, will be of interest. He states that by observing proper precautions in selecting the materials, and in the putting together of the cells, the greatest difference between any cells should not exceed one in one hundred thousand. Furthermore, the temperature coefficient will be still less than that given if the cadmium sulphate solution be made of a certain specific gravity at a definite and rather low temperature, and if no crystals of the salt be placed in the cell; he lays particular stress on the latter point.)

Wheatstone Bridge with Condensers.—In a paper by Mr. Price, abstracted in "L'Eclairage Elec." September 15 (vol. 1 No. 1) he discusses a Wheatstone bridge arrangement in which the resistances are replaced by condensers; as adjustable condensers with such wide ranges do not exist the method is not applicable; the two condensers having a definite ratio might be made with three metallic plates the middle one of which is moved closer to one or the other, the ratio of their capacities being then easily determined by measuring the distances. An intermediate method can be used, two condensers being used for two branches, and two resistances for the other two, a battery being used as a source and a galvanometer or electrometer for determining the equality of the potential; according to Mr. Gott, this method is a very practical one for comparing submarine cable with standard condensers.

Electro-dynamic Spring Balance.—An instrument made by Hartmann & Braun is illustrated and described in the "Elek. Zeit.," September 13; it may be used as an electrodynamometer or a wattmeter; the movable coil has a very long pointer attached to it to indicate the zero position and its torque is balanced by a long spring, the tension of which is adjusted by a drum having a pointer with a scale, the reading of which is directly proportional to the electro-dynamic force, the coil being brought to its zero position; it can be used for alternating or direct currents.

Testing Singlephase Motors.—In an article by Mr. Esson in the Lond. "Elec. Rev.," September 14, abstracted below under "Singlephase Motors," he describes the following purely electrical method for testing them. The motor was belt-coupled with a small direct current dynamo, the field of which was separately excited; the power given to the armature of the dynamo to drive the motor unloaded, minus the loss due to the resistance of the dynamo armature was taken as the mechanical power loss in the system, in friction of the journals, hysteresis in direct current armature, etc., and is called F; the alternating current circuit is then closed and the motor drives the dynamo, the electrical power given out by the armature of the dynamo being measured; the watts measured at the terminals of the dynamo plus the resistance loss in the armature plus the amount F mentioned above, is credited as the power given out by the motor; this may differ from the power measured by a Prony brake, but only by a very minute quantity; the power used in the friction of the alternate current motor bearings is here credited as power obtained, while with a Prony brake this would not be the case, but by comparing his tests with some Prony brake tests he finds that they accord so completely that the difference between the two sets is quite negligible; any power absorbed due to the slipping of the belt would be against the motor.

Locating a Fault in a Submarine Cable.—Referring to the article mentioned in the Digest last week, Professor Jamieson in the Lond. "Elec. Rev.," September 14, intimates that the method is not new and that it is described in Munro & Jamieson's pocket-book.

Fault Current Elimination.—In the Lond. "Elec. Eng.," September 14, Mr. Norman describes a modification of the loop test which is to be used when there is a variable and alternating fault current, which does not stop at zero long enough to make a test; it appears to consist simply in the insertion of a resistance of one megohm in series with a galvanometer, which together form the second circuit to earth.

Photometry and Pupilometry.—The Lond. "Elec. Rev.," September 14, recommends an article by Mr. Henry in the "Jour. Universel d'Elect.," vol. 52, No. 23, p. 514. Gorham proposes a system of photometry based on the measurement of the pupil to which, however, there are objections as other circumstances act upon the pupil; in the present paper means are reviewed and discussed, whereby these measures shall become absolute. (Another paper, possibly the same one, by the same author was mentioned in the Digest, July 7-28 and August 11).

Resistance Alloys.—"L'Eclairage Elec.," September 15 (vol. 1, No. 1) reprints a portion of a book recently published by Mr. Price; the extract contains a brief discussion of the alloys, German-silver, platinum silver, platinoid and manganin, but appears to contain nothing new.

DYNAMOS AND MOTORS.

Singlephase Motors.—In an article by Mr. Esson on mono-phase motors in the Lond. "Elec. Rev.," September 14, he gives the results of tests made by himself about a year ago, with Brown motors of two, one, and one quarter brake-hp for 100 volts and a frequency of 80. The method used in the tests will be found described above under "Measurements." The results show an efficiency of 70.7 per cent. at 1.5 kilowatts, 72.1 per cent. at 0.8 kilowatts, and 71. 4 per cent. at 245 watts, for the three motors respectively, the powers being those given out by the motor. Each armature is wound with two sets of coils, one of which is used only to start the motor as a two-phase motor, the two currents being thrown out of phase by means of a condenser; after starting, the auxiliary coils are cut out; a loose pulley and "striking gear" are used in starting and are said to involve no difficulty, the manipulation of the switch being quite easy; comparing the trouble of starting with that of small gas engines, the mono-phase motor is much to be preferred; the starting current, however, is very high and the power factor very low; the results of the tests are given in a table for various loads including the current, power factor, etc., at starting. In conclusion it is stated that there is still room for a good deal of improvement in such motors.

Theory of the Induction Motor.—A second article of the series by Mr. Kennedy on the elementary theory, is published in the Lond. 'Elec. Rev.," Septemebr 14. He discusses motors which have two sets of poles and use two currents, one lagging behind the other by a quarter of a period, so that when one is at its maximum strength the other is at its minimum or zero value; he uses as an illustration a copper disk capable of rotating between two sets of field magnets; "the currents set up by the one set of poles are acted upon motively by the other set, because the one set of poles is at a maximum flow when the other set is at zero, and the currents induced by one set are at a maximum at the same instant that the magnetic flow of the other set is at a maximum, and thus the motor starts with considerable torque from a state of rest." If, after the motor is started, one of the two currents is entirely cut off the disk will rotate with as much power as it did with the two currents, that is, it will run at a higher speed when at its maximum torque, which leads to the conclusion that two currents are of no use except in starting.

Coupling Alternators in Parallel.—A translation of the article by Mr. Kapp abstracted in the Digest last week, is published with the diagram in the Lond. "Elec. Rev.," September 14.

Motor Generators.—Two forms as made by Swinburne are illustrated in the Lond. "Elec.," September 14, one for delivering direct and alternating currents, for laboratories, experimental shops, etc., and another for charging accumulators at central stations.

Central Station Dynamo.—A full page working drawing, giving the mechanical dimensions, but no electrical data, (not even the output) is published in the Lond. "Elec. Eng.," September 14.

ARC AND INCANDESCENT LIGHTS.

Cost of Incandescent Lighting.—The Lond. "Elec.," September 14, reprints an article from a forthcoming work by Dr. Fleming. He shows that the price is not the only factor to be considered in the choice of incandescent lamps and that consideration should also be given to the rate at which the candle-power decays as well as to the initial efficiency, and the useful life of the lamp; the latter he defines as that part of the life in which its candle-power is not diminished by more than 30 to 40 per cent. of the original candle-power. He shows that the user should determine the total cost to him during that useful life, and calculates several cases, showing that the cheaper is not necessarily the better. The question whether electric light is cheaper than gas cannot be answered by a simple yes or no; he enumerates a number of factors, among which, besides those usually stated, are that it will depend on the constancy of the voltage, the manner in which the wiring is done, the intelligence shown in the placing of the lamps and the care in keeping the lamps clean. A table is given showing the total cost of power in lamp renewals for 200 hours under various conditions, which is useful in making comparisons. To effect economy, the wiring should be done so that, as far as possible, each lamp should have a separate switch, as distinguished from one switch for a group of lamps. For a large class of private houses the average number of kilowatt-hours used per year by an 8-cp 35-watt lamp does not exceed 12 to 20, the latter being generally an outside limit; in clubs, hotels and restaurants, it may reach 30 to 40 and even more; a 16-cp lamp would take about twice that amount; the average total time during which a lamp burns in a private house in a year he gives as 360 to 600 hours. He defines the load factor of a station as the ratio of the actual amount of energy sold to the

amount, which could be sold if the deamnd were constant and equal to the maximum demand.

Alternating vs. Continuous Arc Lamps.—The two systems are briefly compared in an editorial in the Lond. "Elec. Rev.," September 14, to the disadvantage of the alternating arc; one feature which is very detrimental to the alternating arc lamp business is "the insane practice of using so many different frequencies," thus requiring the lamps to be wound for each particular frequency; it recommends that a frequency of about 60 be universally adopted and be made compulsory, which would benefit both the lamp makers and the users, besides giving a great impetus to the alternating motor business. Where a large number of alternating arc lamps are to be used, it would pay to use a rectifying commutator and run the lamps with a unidirectional current, but this would be too expensive, when only a half dozen lamps are used; it is believed that the electrical supply station of the future will give either alternating or continuous currents, according to the desire of the consumer; "when this electrical millenium arrives we have no hesitation in predicting that the alternating arc light will be crowded out by its rival." It believes that we are face to face with a "long felt want" in shape of a cheap and efficient means of transforming alternating into continuous currents.

Projectors.—"L'Eclairage Elec.," September 15 (vol. 1, No. 1) begins a publication of an article by Messrs. Tchikoleff & Turin, translated from the Russian, on the lighting power of projectors with electric light. The original article is from three to four years old and appears to be in the form of a treatise on the subject. The present portion contains a comparison between the inclined and the horizontalz carbons, giving relative figures and showing that in the latter the sum of the luminous rays is 18.6 per cent. greater than with inclined carbons; the Mangin and the parabolic reflectors are discussed, and among other things, the best size of the parabolic mirrors.

A translation of the article on the illuminating power of projectors, which was abstracted in the Digest, August 4, is given in abstract in the Lond. "Elec.," September 14, including the large table.

Mercury Air-Pump.—A new form described by Mr. Kahlbaum in the "Berichted. Deutschen Chem. Gesell.," vol. 27, p. 1386, is highly recommended in the Lond. "Elec. Rev.," September 14.

TRANSMISSION OF POWER.

Transmission Plant.—A description of the Sigmaringen installation is given in "L'Ind. Elec.," September 10, with the aid of a number of good illustrations; the energy is generated by water-power three miles from the town; continuous currents of 1,100 volts and 61 amperes, with a three-wire system, are converted at the distant end by motor generators into current suitable for lighting.

ELECTRIC RAILWAYS.

Liverpool Railway.—The first part of the discussion of the papers by Messrs. Greathead, Fox and Parker, mentioned in the Digest, September 15, are given in full in the Lond. "Elec.," September 14. The discussion is limited almost entirely to the civil engineering features and comparisons with the American roads, and contains but little technical data of importance. An abstract of the discussion was published in the Digest, March 31, the last part of which it now appears was not quite correct and should read that according to Mr. Greathead the maximum tractive force of the Liverpool Railway was 730 lbs. per ton of motor as a maximum at starting, while on the district railway in London the tractive force of the steam locomotive was only 234 lbs. per ton of locomotive, or less than one-third of the above in starting the train. Sir Douglas Fox gives the total cost per mile of different parts of the plant.

Comparative Efficiencies of Electric and Cable Roads.—In a short article in the Lond. "Elec. Eng.," September 14, Mr. Lea makes some deductions from some recently published data on cable roads, showing that as regards efficiency and economical working there is not much to chose between the two systems, and that the only sensible course to adopt is to confine each system to such places as from their nature are specially adapted to the respective systems. He calculates the percentage of horse-power lost in the cable as compared with the maximum horse-power delivered, and finds that it varies in four cases, between about 16 and 31 per cent.; the data for electric roads is not on the same basis and cannot therefore be compared with it directly; he concludes that both systems stand at present very nearly on a level.

Mechanical Traction on Street Railways.—The "Bul. de la Societe des Ingenieurs Civils," for July, contains a very long paper, amounting to a treatise on the subject, by Mr. de Marchena, in which he discusses mechanical traction in general as distinguished from horse traction, gives a general classification, and discusses each system in detail, stating in each case the costs and other data; several of the systems are electrical. An abstract of the article is begun in the Lond. "Elec. Eng.," September 14.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Statistics for Switzerland.—The "Elek. Zeit.," September 13, reprints from a Swiss paper some interesting statistics for the year 1893. Tables are given showing the number of installations used for lighting in each of a number of different industries. Particular attention is called to the co-operative companies, which are meeting with favor and in which the stock is held by the users, and it is thought that this will be the principal form of company in the future in Switzerland. Among the new installations for 1893 there are 40, equivalent to 37 per cent. of the total, in which accumulators are used, a percentage which is exceptionally high and shows the great advantage of accumulators, as also the fact that they have now arrived at sufficient perfection to warrant their use. The total number of lighting installations at the end of the year was 677, an increase of about 21 per cent. over the previous year; transmission of power installations numbered 77, an increase of 45 per cent.; electric motor stations (presumably for the distribution of power) numbered 193, an increase of 105 per cent.; accumulator stations numbered 161, an increase of 33 per cent. Among the prime motors over half are hydraulic; good results are being obtained with small petroleum motors and accumulators for isolated plants; in the transmission of power installations, 16 used continuous currents, while 6 used the three-phase current, and one each single and two-phase currents; only two electric railways were constructed during that year; of the 99 motors installed in that year, 31 were for continuous, 23 for single-phase, 4 for two-phase, and 41 for three-phase currents. The highest continuous currents voltage used is 7,000, and the highest alternating current 3,300. Among the large machines was a 100-hp three-phase generator, the speed of which was only 32 revolutions per minute. Besides the totals above given there are installed 1,407 dynamos and motors, having a total capacity of 28,831 kilowatts; there are 145,949 incandescent lamps and 2,126 arc lamps installed.

Uniform Frequency.—The Lond. "Elec. Rev.," September 14, recommends that a frequency of 60 be adopted universally and be made compulsory; on public supplies it should never exceed 65 nor be less than 50; it is claimed that this would benefit both the arc lamp makers and users, besides giving a great impetus to the alternating current motor business.

Electricity in Mining.—The Lond. "Elec," September 14, states that a new colliery, which is being opened near Eckington, is to be worked entirely by electricity.

Combined Plant for Drainage and Lighting.—A report of such a plant for the town of Monmouth is published in the Lond. "Elec. Rev.," September 14.

Governing of Steam Engines.—The Lond. "Elec.," September 14, publishes an article by Mr. Addenbrooke on the governing of steam engines, particularly when coupled with dynamos.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Minimum Current Audible in the Telephone.—A British Association paper by Lord Rayleigh, is published in full in the Lond. "Elec. Rev." September 14. He quotes the results of a number of observers, and as it is difficult to reconcile them with each other, he made a series of fresh observations, with instruments of the Bell type; the tests are described in detail, and the results given in tables for notes of different pitches; they are in general about as follows: the current in amperes is equal to ten to the minus eighth-power multiplied with figures varying from a minimum of 4.4 for a pitch of 640 to 49 for 307, and 2,800 for 128; the figures increase again for pitches higher than 640, showing a period of maximum sensitiveness in this region.

Quantitative Theory of the Telephone.— A British Association paper by Lord Rayleigh on an attempt at such a theory is reprinted in full in the Lond. "Elec. Rev.," September 14.

Researches with Telephone Induction Coils.—The "Elek. Zeit.," September 13, contains an article by Mr. Christiania, discussing the subject of induction coils and describing experiments to study the actions of the induction coils and to find the best conditions for the best effect. He shows that they act not only electro-magnetically, but at the same time as a condenser. His conclusions are that for telephone stations, an induction coil, in which the two coils are wound over each other, is undoubtedly preferable to one wound with a bifilar winding.

Long Distance Telephony.—It was recently announced that a line from London to Berlin was under consideration, but it appears from the "Elek. Zeit.," September 13, that this is a mistake, and that the line is not under serious consideration.

ELECTRO-CHEMISTRY.

An Improved Primary Battery.—The Lond. "Elec. Rev.," September 14, mentions briefly that it had occasion to see the electric launch "Velvoca," in which the cells weighed 30 lbs. each, 48 of which propelled the launch at five miles for ten hours, carrying twelve persons comfortably, a performance which it believes exceedingly good; the expense per horsepower is apparently great, but when everything is considered, this may not prove to be an important matter; a full description is promised; the battery is an improved Smeed type, in which the hydrogen is thrown off by fine filaments of carbon; the inventor believes that a low electromotive force, coupled with constancy and extreme simplicity is preferable; the battery consists of carbon and zinc in dilute sulphuric acid, and gives only half a volt per cell, but is remarkably constant. Some further data is published in the Lond. "Elec.," but as a full description is promised in the other journal, the details will not be abstracted here until next week.

Electrochemical Economy.—An editorial in the Lond. "Elec. Rev.," September 14, calls attention to the present use of water-power in the manufacture of certain chemicals by electric processes; about 600,000 kilograms out of 1½ to 2 million kilograms of chlorate of potash

quired annually, are made at Vallorbes in France by an electric process by means of a 2,000-hp water-power, and a much larger installation exists in Sweden (see Digest of last week).

A Cheap Insoluble Anode.—Mr. Fitzgerald, in the Lond. "Elec. Rev.," September 14, again calls attention to the fact that lithanode (a conductive peroxide of lead) can be used as an anode in the electrolysis of earthy and alkaline chlorides; he claims that it is cheap, and that his statement that it is absolutely inattackable by electrolytic chlorine and oxygen has never been denied; he also suggests that it might be used as a diaphragm in commercial electrolysis, as it is attacked neither by chlorine nor by caustic alkali.

Electrolytic Production of Nickel and Cobalt.—A new process of Mr. Hoepfner for obtaining these metals in their purest state is briefly mentioned in the Lond. "Elec Rev.," September 14.

Electricity Direct from Coal.—The Lond. "Elec. Rev.," September 14, abstracts Dr. Ostwald's recent paper (see Digest, July 21, under Electro-Chemistry.)

MISCELLANEOUS.

Physiological Effect of Magnetism.—In discussing a recent statement by Dr. Luyes on a magnetized head cap, which is evidently absurd, Dr. Hedley, in a communication to the Lond. "Elec. Rev.," September 14, gives a brief summary of experiments, showing that science knows nothing of the action of magnets on the human body, except the apparent absence of action; if such magnets are used in medicine, and have any effect at all, their action must be purely physical, and that, therefore, a wooden magnet might do as well.

Trolley Balloon.—"L'Eclairage Elec.," September 15 (vol. 1, No. 1), states that the proposed trolley balloon (see Digest, January 27, May 26 and September 8) at the Antwerp Exhibition, has turned out to be a complete failure; some of the data is given. (Why three-phase currents requiring a triple trolley and three trolley wires, was to be used, is not stated.) The cause of failure is not given, but it is stated that the tension on the cable was very great.

Movable Shears.—A powerful shears for cutting bars of metal, driven by an electric motor, and secured on a track on rails, taking its power from a trolley wire, is illustrated in "L'Ind. Elec.," September 10; it is used in a wire factory, and it has been found that there is a considerable saving in time gained by bringing the shears to the work, instead of bringing the work to the shears.

Electrical Steering Compass.—A well illustrated description taken from "La Nature," of the instrument described in the Digest, June 2, is published in the Lond. "Elec. Rev.," Sept. 7.

Balloon Struck by Lightning.—The Lond. "Elec. Rev.," and "Elec.," Sept. 7, record a recent case in which a captive balloon was struck by lightning in a storm, setting it on fire and seriously injuring the men who were about to lower it.

Exposition at Lyons.—"L'Eclairage Elec.," September 15 (vol. 1, No. 1), gives the first part of a description of the distributing stations at this exhibition.

Educational.—The City and Guilds' examination questions on electricity are published in the Lond. "Elec. Eng.," September 14. The same issue contains a lecture at this Institute on the principles of electric circuits, in which hydraulic analogies are given.

Biographical.—A biographical notice of the late Professor Von Helmholtz is published in the Lond. "Elec. Rev.," September 14; the Lond. "Elec.," contains an editorial on Helmholtz; a biographical sketch from the London "Times" is reprinted in the Lond. "Elec. Eng."

"L'Eclairage Electrique."—A new French journal, with this title, has just been started, the first number bearing the date September 15, 1894. A circular states that it is intended to fill the place left vacant by "La Lumiere Electrique," which is no longer published, and it will have articles from the same contributors and collaborators. In all but its external appearance it is quite similar to "La Lumiere Electrique," except that it is published in less elaborate style and contains much fewer illustrations. The director is Dr. P. H. Ledeboer, and the subscription price for the United States is 60 francs (about $12). It is published at No. 24 Rue Chauchat, in Paris.

A New Electric Street Railway Journal.

We have received the prospectus of a new weekly trade journal, to be called "The Trolley," which, we learn, is to be "devoted to the interests of the trolley systems of the United States, South America, Europe, Australia, etc." The journal will be published by the Shakespeare Press, Westfield, Union county, New Jersey.

The Electric Canal-Tugboat.

BY F. M. F. CAZIN.

Since Archimedes determined the effect of the immersion of a solid in a liquid medium 2,180 years have passed. But it is a very few years only since the effect of the movement of the immersed solid within the medium has found a precise valuation, and many a learned engineer even at this date is unaware of a natural law existing by which this valuation is determined

The law is expressed as follows:

A solid, when moving in a medium, causes a quantity of the medium to move in a direction inverse to the movement of the solid; and this quantity of the medium inversely moved is as the product of the volume displaced by the first immersion or submersion of the solid by the distance of travel, divided by the length of the solid, such length being measured in the direction of relative motion. And the distance, for which this stated quantity of the medium is inversely moved, is as the said length of the solid. And aside of the quantity of the medium so permanently and inversely moved by the movement of the immersed solid another quantity of the medium is temporarily moved out of its previous position, when the moving solid has a non-uniform transverse section, which other quanity of medium returns, when the solid has passed by, into the same position previously occupied, therefore absorbing no power and offering no resistance. And the quantity of medium only temporarily moved is as the product of the length of travel by the difference between the transverse major section of the solid and the transverse average section of the moving solid. And the transverse average or uniform section of the solid is as the immersed or submerged volume divided by its length, such length being for all cases of relative motion measured in the direction of such relative motion.

From this law, which for the sake of shortness and complimentary to its discoverer is now called "the Cazin displacement law," there has been drawn, amongst many others, the following conclusion:

The power required for producing motion of a ship at a velocity v is as

$$y \times \frac{1}{75} \times \frac{B}{d} \times v \times \frac{v^2}{2g} \text{ metric horse power*}$$

And this power must be directly applied to the moving of the quantity of water per second from bow to stern.

To effect this in the most direct manner, the propeller screw or screws may be located inside of a longitudinal tube open at both ends to the water, that produces buoyancy, such tube leading in a straight line from bow to stern. The most objectionable part of the present construction —the cumbersome and unreliable propeller-shaft may thus be avoided, the motive power being transmitted to the screw at its circumferential line by a geared ring. (Compare the Journal of the Franklin Institute for May, 1893.)

The method of ship propelling thus indicated is herewith illustrated in its application on an electric canal power boat.

It is not the intention here to enter on any discussion as to preferable form of screw or of its necessary dimensions and number of revolutions required for producing a stated power, viz.: for removing a stated quantity of water from bow to stern; but the intention is to describe an arrangement, which closely adapts istelf to the requirements of the case in view of its real nature.

The essential conditions for the construction of a practical electric power-boat for canal traffic, this is for economical and effective towing, therefore, are as follows:

1. That its propelling power be adequate to move in inverse direction to its own travel the quantity of water expressed by $\frac{B}{d} \times v$ metrical tons per second, the value of $\frac{B}{d}$ relating to the entire string of boats to be moved in one close train.

2. That the inversely running current of water produced by the power applied is not diverted from its direct inverse course, that is, not diagonally diverted, but moves from bow to stern of the entire train of boats in as straight a line as practicable.

1. Under the newly discovered natural law hereabove quoted the ultimate and direct requirement of power for not only moving the power-boat but in addition thereto a number of canal-boats, is so specified, that the quantity of water moved inversely by the machinery measures correctly its propelling power. And with this water flowing through a tube, as in the new power-boat proposed, this quantity of water can be easily measured, or calculated, or the dimensions of tube and screw as well as the latter's number of revolutions determined.

The drawing shows an arrangement where within a longitudinal tube passing from bow to stern of the power-boat, there is inserted an other shorter tube, that contains an archimedean screw. The inner tube has two outer rings, one of which runs in supporting wheels and the other of which rings has aside of running on supporting wheels also gearing, into which other gear-wheels work for conveying motion to the inner tube. These power-conveying wheels run in a recess of the longitudinal and longer tube, their shafts passing through the side-walls of the recess and receiving power from electric motors set up in the power-boat.

The inner tube containing the archimedean screw may also run with its wall in a recess of the longer tube.

The present description being intended only to describe the new ar-

* B signifies the ship's immersed volume or its buoyancy in metric tons.
d signifies the ship's length measured in the direction of her motion and on her water-line.
v signifies the ship's velocity of travel or her speed per second, expressed in meters.
$\frac{v^2}{2g}$ signifies the elevation, to which a weight must be lifted for acquiring in its subsequent fall an ultimate velocity $= v$.
y signifies 1,000, by the use of which co-efficient the value of metric tons for B is mopified into kilogrammes, and in consequence the total value into kilogram-meters, of which 75 make 1 metric horse-power.
g signifies twice the distance, which matter, when free to fall will pass in the direction towards the earth's center within the first second of such free fall. This distance g, being as $g = 9.78009 + 0.05080 \sin^2 \psi$ (ψ = geographical latitude) meters.

rangement in general, no claim is made as to accuracy of dimensions or even of form.

2. "From bow to stern' is the condition, the essential condition relating to the flow of the water, that is inversely propelled by the machinery. For the power-boat itself this condition is fully attended to by the water flowing all through the longitudinal tube, which tube, occuping the meta-centre of the boat, is of necessity open at both ends and its inner space is virtually outside of the boat and does not count in making up the buoyancy f the boat.

Care must therefore be taken, that the water ejected at the stern of the power-boat, shall pursue its course to the end of a string of canal-boats without being diagonally diverted. And this is effected by the parallel-rudders, one on each side of the stern part of the power-boat, that will force the ejected water to closely follow the side-lines of the canal-boats, that are closely following the power-boat. The entire string of boats thereby is made to act, as if it were one long moving boat.

As giving superiority to this arrangement when compared with all other older or possible newer form of power-boat and method of canal towing the following facts are claimed:

(1) Under this system the application of the trolley system to canal boat propulsion is made free of all objections, that might be raised against the introduction of this system either on the part of the owner of the canal or on the part of the owners of canal-boats, as will be shown herebelow.

(2) Under this system the provider of power can give to the boat owner double the present speed for the same price, that the boat owner now pays and yet make himself on the price so paid a very large percentage of profit, this is larger profits, than he could possibly make under any other system.

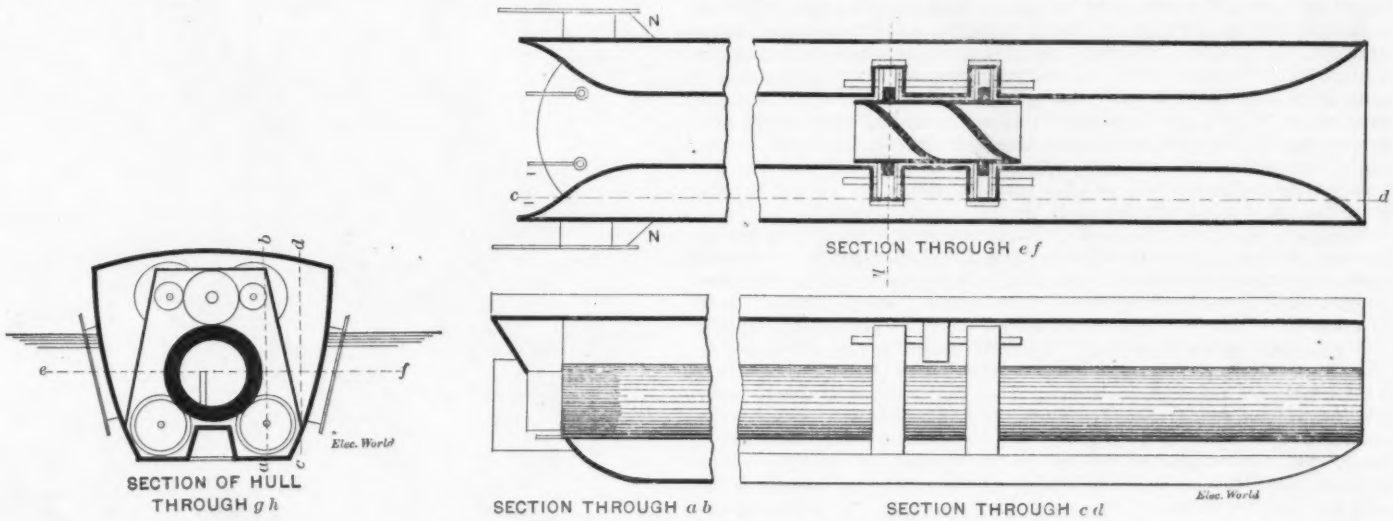
boat under the new system performs many times the work that a steam tug of the same nominal horse-power now performs, even up to 10 to 20 fold of this work as now performed.

And it does so perform a 10 to 20-fold amount of work in the same time, because its construction is adapted closer to the natural conditions of the case and because its method of working is by far more rational than the old method, all of which results in this, that under this new method or system of canal transportation the cost per ton and mile transported at the same speed as against animal traction will be only from one-tenth to one-twentieth of present actual cost and only one-fifth to one-tenth of what the cost would be under the trolley system without the application of the new propeller system and of the making up of close trains made possible under this system, all of which the following calculations will show and prove and all of which practical test will verify.

The two John C. Trautwines in their Civil Engineers' Pocket-Book (Edition 1891, p. 376), when speaking of traction on canals and of the power required for such traction, use yet the following expression: "The whole subject is too intricate to be treated here."

Had the junior author taken cognizance of what in 1886 was published on the subject (See Van Nostrand's Engineering Magazine, Sept., 1886, The Limits of Speed in Ocean-travel) of power required for propelling ships, all intricacy of the subject would under the newly discovered and there published natural law, as it is quoted hereabove, have disappeared.

Present canal-boats on the Erie Canal have a total initial or first displacement (B), when with full load, of 105 metric tons or cubic meters of water, of which 30 tons relate to the boat's dead weight and 75 tons to useful load. Their length on the water-line (d) is 80 ft. or 24.4



ELECTRIC CANAL-TUGBOAT.

And the technical causes for these results are as follows:

(a) A propeller arranged as described is more effective than one running at the boat's stern without a circumferential cover, because here is no loss of effect by mere centrifugal action, this is no "slip."

(b) The access of water to the propeller under the new arrangement is a direct and perfect one, being exclusiely in the sole direction, in which it gives propelling effect to the screw, it having been experimentally proven, that a disk in front of any propelling screw destroys its propelling effect entirely.

(c) The water ejected at the stern-end of the power-boat is kept in a true line of flow by the rear-end of the tube widening out, allowing the water to skirt the bow of the next adjoining canal-boat, and is further kept on this line by the parallel rudders set at proper distance by the connecting rods and the hooking rods from the sides of the boat giving direction to the adjoining portion of the canal water, thus forcing the inner current to pursue its course directly towards the stern of the boat-train.

The parallel rudders are set to inclose a wider space than the beam of the following boats and they project beyond the stern of the power boat as far as practicable.

(d) The advancing train under proper execution of the new system displaces at its bow just so much water as must be and is inserted in the space previously occupied at its stern. And no false or diagonal current being produced, there is abolutely no washing of embankments, the only possible wash being below the boat on the line of their travel.

(e) The water ejected between the two inner rudders is instrumental to a quick obedience of the boat to the action of the rudder, the manipulation of the boat being thereby greatly facilitated and a closer range of movement being thereby secured.

It now remains to subject the financial side of the question to a close scrutiny, in order to demonstrate the fact stated under (2) in the preceding statement.

Assuming the cost of the electric power-boat to be not less than the cost of a tugboat with steam boiler and steam engine, and with the cumbersome and costly unreliable propeller-shaft, then the electric power-

metres, and in consequence they have a transverse average section $\frac{B}{d} = \frac{105}{24.4} = 4.303$ square metres, or = 4,303 mili square metres.

Two horses do in actual practice tow such a loaded boat for 8 consecutive working hours out of the 24 at a speed of 2 miles an hour, or 3,213.25 metres in 3,600 seconds, or at the rate of 0.8926 metres per second.

This is equivalent to inversely moving $4{,}303 \times 0.8926 = 3{,}841$ kilogrammes of water at the speed of 0.8926 metres per second, or from bow to stern. And this work is equivalent to lifting the said quantity of water to an elevation $S = \frac{v^2}{2g} = \frac{0.8926^2}{19.62} = 0.04$ metres.

And to accomplish this a power of propulsion must be applied as follows:

$$P = 1{,}000 \times \frac{B}{d} \times \frac{v^3}{2} \text{ watts, or}$$

$$P_1 = 1{,}000 \frac{B}{d} \times \frac{v^3}{2} \text{ kilogrammes-metres, or}$$

$$P_2 = 1{,}000 \times \frac{B}{d} \times \frac{v^3}{(2g \times 76.04)} \text{ horse-power.}$$

With $B = 105{,}000$ kilogrammes,

$d = 24.4$ metres,

$\frac{B}{d} = 4{,}303$ square metres,

$v = 0.8926$ metres,

$v^3 = 0.71113$ metres,

$g = 9.81$ metres, and

we shall find $P = 1{,}530$ watts,

$P_1 = 156$ kilogram-metres and

$P_2 = 2.183$ horse-power,

Which is in full harmony with the work actually done by life-power, that is by the two horses now used.

But electric canal traction will not probably confine itself to the slow speed of animal traction.

With a traveling speed of 4 miles an hour the 363 miles of the entire Erie Canal, locks excluded, can be made in traveling day and night, a possibility well secured by the use of electric head-lights, in about 4 days, and including locks, surely in 6 days, or in about half the time it takes with animal power and the incidental loss of time therewith connected.

Paying $3 per horse for 8 hours' real work, the cost to the boat owner per useful load and ton-mile is 75x16 equals 1,200 ton-miles for $60 precisely equals ½ cent per ton-mile.

This is the figure, with which a new venture in providing power for canal traction will have to reckon.

For a speed of 4 miles an hour the above stated figures must be modified as follows:

$$v \text{ becomes } v \times 2 = 1.7852 \text{ metres per second, and}$$

$$v^3 \text{ becomes } v^3 \times 2^3 = 0.71113 \times 8 = 5.689 \text{ metres per second.}$$

And in consequence we find for double speed an eight-fold requirement in power, or

$$P = 12{,}240 \text{ watts, } P^1 = 1{,}248 \text{ kilogram-metres, and}$$
$$P^2 = 17.464 \text{ horse-power.}$$

If electric power derived from a source consisting in the combustion of fuel or in the fall of water would not cost less than animal power, then the motive power at double speed would cost per ton-mile 8x0.5 equals 4 cents, unless the same power would under the new system produce a better effect. By digesting the given figures under the natural law as stated it will be found that with a string of boats closely connected and with the provisions made for keeping the counter-current produced and conditional to the progress of the boats in the proper direction, the number of boats towed by the same power-boat can be multiplied. Getting 8 boats into one train then would leave the cost of propulsion the same, though the speed be doubled. And putting 16 canal-boats behind one power-boat in a close string with all the provisions required in that case to keep the back-current produced by the propeller-screw in the straight direction towards the stern-end of the closely arranged train, the cost of propulsion would be reduced to half, while the speed would be doubled.

It appears, therefore, that aside of the saving produced by substituting the electrical power derived from the fall of water, for animal power, the new system secures with the present or old speed a reduction of cost to only a fraction, say one-eighth or less of the present cost, and with double speed either leaves the cost the same or reduces it, according to whether a train contains 8 canal-boats or more.

At all events there is ample room for allowing to the owner of a boat better conditions either as to speed or as to price of power, or as to both, and for a good margin over cost to the power-producer, aside of the power offered being more reliable and more continuous than animal power, and in consequence more attractive for traffic in heavy goods in general. In this may be found a confirmation of the following statement made by the author of this paper in December, 1891, when the application of electric propulsion to canal traffic as yet was not receiving any attention:

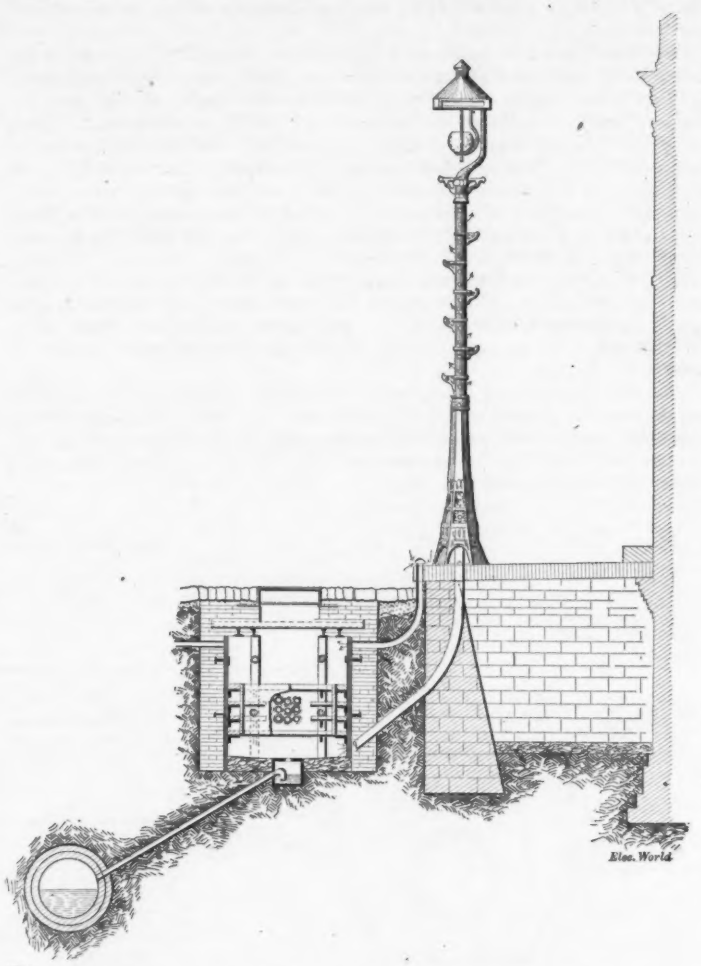
"Were canal transportation made as continuously reliable as railroad transportation has practically become, both for quantity transported and for speed of delivery, it would constitute a more formidable competitor to railroad transportation than it actually is at this date, on account of higher economy in water as against rail-transportation. With a public canal system extensively developed, and a general motive power supplied for progress that will not destroy the canals themselves, and that will never fail but be ready at any time, the intercommunication of the people at large may once again be emancipated from the dominant power now exercised on its political and economical fate by the oligarchy that has arisen, from practical alienation from the people at large of its means of inter-communication for the benefit of a privileged class of financiers.

And this much needed, unfailing, lasting and omnipresent power on the canals of the country can be made available by naught but by electric transmission of power, from where it is obtainable at lowest rate of cost under some such system as the trolley, applied to all vessels navigating the public canals."

In so far as the American system of government does not admit of operating the means of transportation by such government itself, except by contract at large and for mail service, it is of necessity that private enterprise must be relied upon for the realization of this progressive step in national economy.

Underground Wires in Chicago.

The grades of the streets in the central part of Chicago have been raised from 5 to 15 feet. Strong area walls were built on both sides of the street, about 16 feet from the building lines, and the centre of the street filled, leaving a natural basement or cellar between the area walls and building walls. The City Street Department controls the street from building line to building line, and consequently the city has control of this natural basement under the sidewalk, and can use it for its own wires and cables, or give permission to other electric corporations (through the City Council) to do the same. Such permission has been given to several corporations, notably the Chicago Telephone Company, and the Chicago Sectional Electric Underground Company. The city fire alarm and electric light wires and cables where placed under the sidewalk are enclosed in steel pipes, generally 2 inches in diameter. Where they "tap out" to fire or police alarm boxes or electric lamps, a break is left in the pipes, which, after the wires are in position, is closed with a split cast iron tee, so that the wires and cables are enclosed in



UNDERGROUND CONNECTION TO ARC LAMP POST.

iron or steel throughout, thoroughly protecting them from mechanical injury.

The Chicago Telephone Company and the electric light companies renting duct space from the Sectional Underground Company, use this sidewalk space for distribution, the conductors entering it from manholes at street intersections and passing along the area wall in lead covered cables, in some cases protected with iron pipes, or in wooden boxes fastened to the wall, and often with no mechanical protection outside of the lead. The accompanying cut, showing an electric lamp post and pipe entering it from a manhole, will give an idea of the general appearance of the area under the sidewalk. The pipe entering the lamp-post is used as a tube, wherein the wires can be placed and protected, and when perforated above the cast-iron base, it acts as a ventilation for the manhole.

A Novel Application of Accumulators for Traction Purposes.

There is a double-track section of about a half mile of the Chicago North Side Passenger Railroad Company in the heart of the city over which the company finds it necessary to run its cars, but on which it cannot get trolley privileges. For this purpose the Electric Storage Battery Company, Philadelphia, Pa., will furnish the road with trucks, each carrying 240 battery cells of the "chloride" type, but nothing else except a motor-man and a small motor sufficient to run the truck for switching purposes, but not sufficient to run a car.

When a car arrives at the end of the trolley-wire a truck will run in behind it, couple on to it, and connect its battery with the motor on the car, and the motorman on the car will operate it the same as though he had the trolley, the voltage of the current being the same. When the car reaches the end of this section of the line the truck will be uncoupled, mechanically and electrically, switched around by its own motor and connected to another car going back to the other end.

It is expected that on this part of the line there will be 25 cars in use in the busiest part of the day, and the battery company is to furnish 40 trucks equipped with batteries, which will be charged in place on the trucks, the number relieved from duty in the slack times, with the reserve of 15, being estimated as sufficient to allow this to be done.

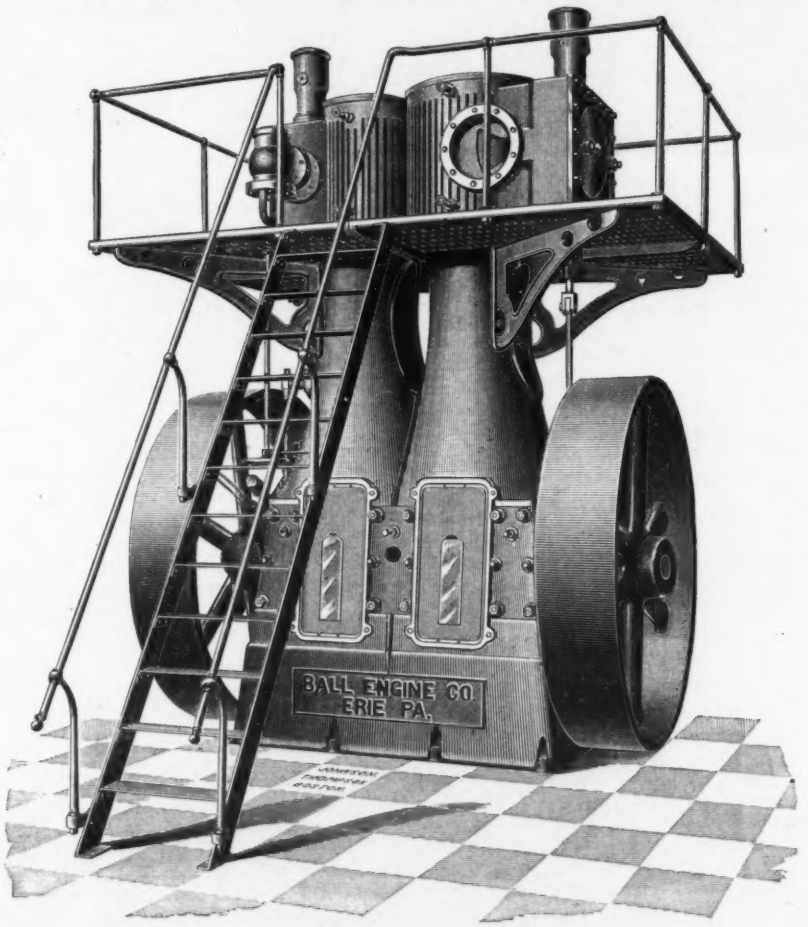
A New Vertical Engine.

In the design of this engine, the makers, the Ball Engine Co., Erie, Pa., have aimed to produce a machine whose structure would be of such a form that the main pieces should be absolutely rigid and indestructible and allow of easy access for adjustment or removal of any part that is subject to wear, and while covering those points to produce an engine whose steam distribution is symmetrical on both sides of all the pistons, whether one, two, three, or four are used; in other words, an independent valve motion for each and every cylinder employed, and each of these being a perfect engine in itself.

By reference to the cut the symmetrical form of the upright housings will be noted, which are made to constitute one double housing by having one side of each planed and bolted together in the centre of the middle shaft bearing. This substantiality is still further increased by the operation of planing the bottom of both housings to one continuous flat surface to meet the planed surface of the top of the single base plate to which the bottoms of the housings are substantially bolted.

The introduction of the shaft into this engine is accomplished by arranging the shaft boxes in a large jaw cutting into one side of the housing deep enough to bring the centre of the shaft in a plane with the centre of the housing, finish spots being provided to meet correspondingly finished surfaces upon the cast iron boxes.

These boxes consist of one lower, two quarter, and one top box for each journal, and these are provided with removable babbitt metal shells upon which the journals bear. These shaft box jaws are in turn closed by the use of heavy struts or plates having on their inner faces a V-shaped tongue on each end, which fits into a corresponding groove



VERTICAL COMPOUND ENGINE.

planed on each side of the jaw. These struts are fitted so that when bolted in solidly by the four bolts in each, the jaw is closed and completes the symmetrical strength at the four corners of each housing. Each strut is fitted so that there can be neither contraction nor extension of the outer end of the jaw.

Each housing is also pierced by a large rectangular opening on each side (shown covered by a door bolted on) as wide as the space between the inner edges of the struts, and extending both high and low enough to allow the cranks with their counter-balancing discs to pass. Hence, with shaft, boxes, and struts in place, to close up the engine it is only necessary to put up and secure large doors, which in turn are provided with a small shutter plate covering an opening large enough for the insertion of one's hand to feel the connecting rod strap when the engine is in motion and to admit the necessary wrenches to key up the crank boxes when so desired. The adjustment of the journal boxes is accomplished by turning the three set screws shown in each strut, the two in the centre reaching the quarter boxes while the third one above operates either in or out a wedge which fills between the upper side of the jaw in housing and the top box. This gives independent adjustment for three parts of each box while the lower box is perfectly free to move at right angles to the axis of shaft, thereby giving for all positions of adjustment of the quarter boxes a full bearing for the shaft.

Above the openings for the shaft the housing becomes a round taper column, having on two sides of its inner surface crosshead guide surfaces which are cast in place and bored out co-incident with the boring and facing of the upper end for the reception of the cylinders and the lower end for a seat upon the base. The other two sides of each housing are pierced by elliptical openings, affording easy access to the crosshead and upper end of connecting rod.

This form of housing makes a structure that is strong, convenient of access when desired, clean as to any dirt leaving the engine, and entirely closed as to any dirt from the outside entering the engine, along with a natural ventilation past the shaft boxes up the column and out of the elliptical openings therein.

The shaft is of one piece of forged steel from end to end, the crank pins being 180 degrees apart and cut out of the solid down to their round diameter, and, as are the journals, ground to a perfectly round smooth running surface. The pins are provided with centrifugal oiling holes in addition to the regular supply through the usual tube reaching from the upper to the lower end of connecting rod.

Covering each pair of crank bells is a pair of discs carrying a sufficient amount of counter-weight to give a perfect running balance to the cranks and the reciprocating parts, so that there is practically no vibration to be communicated to the housings, and hence to the upper works of the engine.

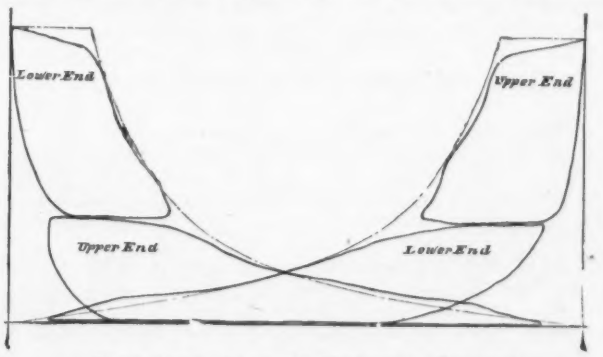
The connecting rods are of forged steel, the upper end being solid and cut out for the reception of the brass crosshead box and the removable crosshead pin—the latter being very carefully tapered through the crosshead and held in place by a fine threaded nut; the lower end is provided with a strap which, owing to the arrangement of bolts and cross keys, constitutes a solid end rod for the crank as well as the upper end, and both ends are provided with a wedge adjustment that in operation does not alter the length of the rod.

The crossheads are of the double plate pocket type, as used in many makes of Corliss engines, and are provided with taper shoes to compensate for any wear that may occur against the guides, the shoes being of cast iron with the large running surface entirely covered with babbitt metal.

The piston rods are of crucible steel, screwed into the crosshead. The stuffing boxes are adapted for the use of fibrous packing unless otherwise ordered. The pistons are of the double plate type, held up to a solid collar and taper by a well-fitted nut. The piston packing is made up of two self-adjusting parted rings and a broad junk ring for centering and guiding the piston in the cylinder.

The cylinders are made of charcoal iron mixed in such proportion of hard and soft as to produce a very strong, close-grained iron which enables the surfaces to take a mirror polish. They are provided with single valves, each of which is practically one piece so far as the motion and wear are concerned.

The high pressure valve is of the double-faced telescopic relief type, with boiler pressure on the inside and sufficient amount of unbalanced



INDICATOR CARD OF VERTICAL ENGINE.

area being left on the faces that the force of the steam on the inside forces the two faces apart, causing each to rub against the seat with sufficient pressure to keep the surfaces polished and steam tight through the entire life of the engine.

The low pressure valve is of the common letter D type with improved proportions and construction, and is provided with a round relief area upon its back operating against the chest cover, being a large, well-proportioned valve that runs with the greatest ease and yet follows up its wear without attention from the outside. The indicator diagram shown demonstrates that where single valves of proper design are used the steam distribution can be made pratically perfect. The one great governing fact in the use of steam is recognized, namely, that a small leakage will more than destroy the useful effect of very elaborately worked out valves and motions. The makers have, therefore, confined themselves to the work of perfecting and simplifying the simplest and best form of steam valve.

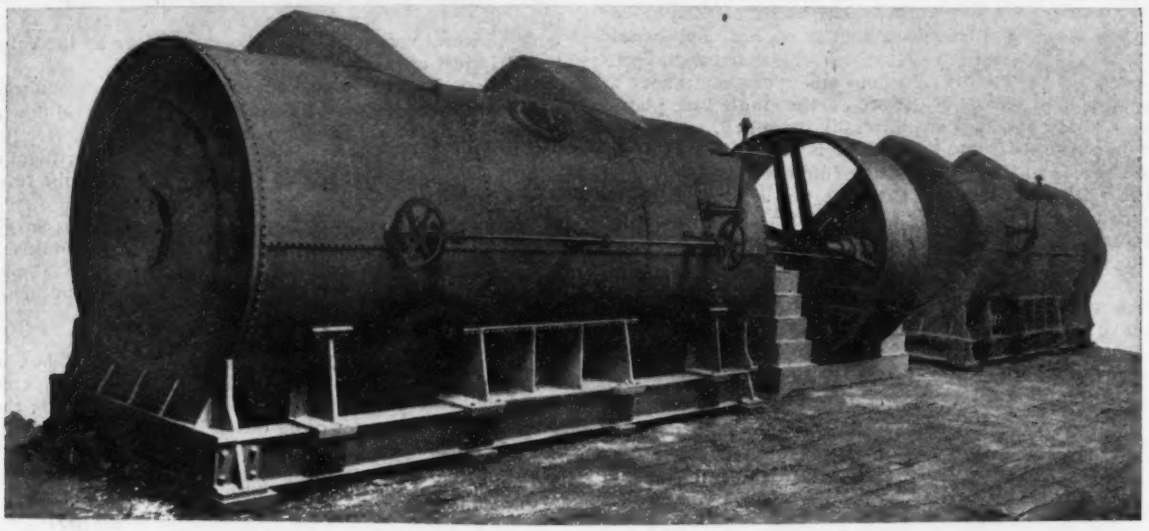
A few facts that were developed in a recent test of this engine are as follows:

The engine is employed in electric railroad driving and is supplied with steam at 125 lbs. gauge pressure and exhausts into a practically

uniform vacuum of 24", and was driving (at the time this test for total variation from standard speed was made) 425 to 435 indicated horse-power. To observe the variation a tachometer was attached to the main shaft. When all was in readiness and the full load was on, the switch controlling the whole current leaving the station was opened, thus dropping the entire load instantly, and the engine made a momentary flutter up to 235 revolutions and back again to 233 revolutions. The circuit was kept open while the attendant counted ten and was closed as suddenly as it had previously been opened, when the tachometer showed the engine making the same momentary flutter down to 231 revolutions and back again to 233, taking up instantly a load of about 400 indicated horse-power. This test demonstrated that the governor used was in absolutely isochronous adjustment, that the valves were absolutely steam tight, and that this degree of control over an engine of this magnitude using such a pressure and dischariging into a vacuum, was remarkable.

This engine is guaranteed not to vary in speed from full load to no load, and vice versa, more than one per cent., hence as the test showed but eighty-six one-hundredths of one per cent., it was conceded that the guarantee was fulfilled in very good form.

The governor is made of the best materials, the points of severe contact being provided with hardened pins and renewable soft bushings, thus throwing the wear into those parts that are easily and cheaply replaced. The outward appearance of the engine is neat, symmetrical, and at once demonstrates that in this arrangement has been accomplished a great reduction of floor space required for this amount of power.



Turbines of Woonsocket Plant.

A Large Water Power Electric Plant.

The Woonsocket, R. I., Electric Machine and Power Company, has extended its electric plant, thus relieving its former station and concentrating its street railway plant in a location that would require less wire, by purchasing a large water power and installing two pairs of 36-inch cylinder gate Victor turbines, which are operated under 17 feet working head and develop 600 horse-power.

Each pair of these turbines, which were manufactured by the Stillwell-Bierce and Smith-Vaile Company, Dayton, O., is mounted in a separate wrought iron flume, to which the water is conveyed from the forebay outside of the building, by means of two wrought iron feeder pipes, which enter the flume nearly over each turbine. Each feeder pipe is supplied with a head gate, by which the water can be entirely shut out of the flumes in case it is found necessary to enter for examination or repairs. The flumes are also supplied with a cover at each end, which can be removed, leaving an opening large enough to remove any part of the turbine.

Each pair of turbines discharges into one draft tube, and with this arrangement, the two turbines discharging towards each other, no steps are required when both turbines are running, as all the end thrusts are balanced, but as the gates of these turbines are arranged so that one turbine of each pair, or one pair and one turbine of the other pair may be run, steps have been supplied. Each pair of turbines has a governor for regulating the speed. Midway between the two flumes is the main driving pulley which is 11 feet in diameter, with a width of face sufficient for a belt 48 inches wide. The speed of the turbine shaft is 133 revolutions per minute, and a belt speed of 4,595 feet per minute is obtained. The pulley is keyed to a steel shaft 7⅛ inches in diameter, which runs in the latest pattern self-oiling swivel boxes. Connecting each end of the shaft which carries the large driving pulley with the shaft from each pair of turbines, is a Worrell friction clutch coupling, so that the pulley may be driven with either or both pair of turbines.

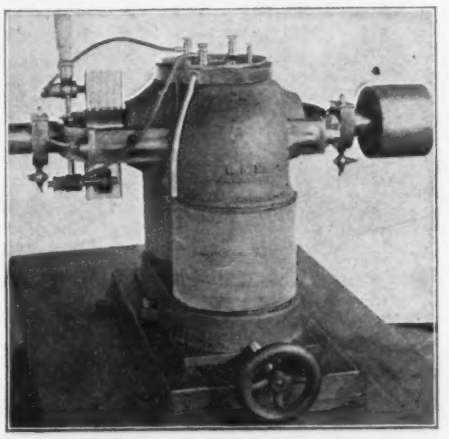
On the floor above the wheels, running parallel with the front of the building, is a heavy line of 6 inch shafting with a receiving pulley with 51½ inches face and 64 inches in diameter connected with the wheel shaft by a three-ply belt 50 inches in width. To the left of the receiving pulley are three driving pulleys, each 69 inches in diameter, and 15½ inches face, each operated by a Worrell or Laconia friction clutch. These pulleys are for driving the power generators, which are connected by 15-inch three ply-belts, and installed on massive brick and stone foundations to solid ground 10 feet below the water line.

To the right of the receiving pulley is another pulley 69 inches in diameter, with a 15-inch face, operated, as are the others, by a Laconia clutch, which will be used to transmit power to the rooms above as they may be leased for manufacturing purposes.

The three generators placed in this mill will be used in conjunction with another very powerful machine to be located in the old station, to transmit there the water power from this plant when not at all or only partially in use.

The Roth & Eck Dynamo.

The accompanying cut illustrates a 50-light dynamo manufactured by Roth & Eck, 30 Market street, Chicago. The electrical design and insulation have received much attention. The machines are mechanically and magnetically symmetrical, sparking at the commutator under all changes of lead being thereby obviated. The armature is made up of thin, soft iron discs, separated by thin discs of paper and mounted on a steel shaft. Great care is taken in winding the armatures to secure perfect insulation and mechanical firmness, and they are carefully balanced to avoid jarring when the machine is running. The depth of winding on the armature is small to avoid self-induction in the armature, thus preventing sparking. The commutators are made of special hard commutator metal, insulated throughout with mica. The field magnet is large and strong and of the simplest horseshoe type, with cylindrical cores of the softest wrought iron. The wire of the fields is wound on a separate spool; the winding is thus made easily replaceable, and spools can be furnished for any voltage if a change should be desired, which can be made with very little work.



Fifty-Light Dynamo.

New Books.

HOW TO BUILD DYNAMO-ELECTRIC MACHINERY. Embracing Theory, Designing and the Construction of Dynamos and Motors. With Appendices on Field Magnet and Armature Winding, Management of Dynamos and Motors and Useful Tables of Wire Gauges. By Edward Trevert. Lynn: 339 pages, 178 illustrations. Price, $2.50.

This is another of the innumerable works, principally compilations, of that mysterious author, Edward Trevert, who, though the maker of the most extensive list of electrical books ever put forth by one author, is yet, as far as we can learn, utterly unknown to electricians, either in person or by professional reputation. As another singular circumstance, we note that Chapter VIII of this book reprints verbatim and without credit, the contents of a book issued by the same publisher entitled "How to Build a One-Fourth Horse Power Motor or Dynamo," and which has the name, A. E. Watson, on the title page, as author, and that Chapter XIII is similarly a reprint, verbatim also and without credit, of another book by Watson published by the same firm, entitled, "How to Build a 1,000-watt Alternating Current Dynamo or Motor." We find further, that Chapter XI is identical with Watson's book, "How to Build a One-Horse Power Motor or Dynamo," and nowhere do we find any indication that Trevert is not the original author of these three chapters, the use of the personal pronoun, in fact, implying directly the contrary. The latter half of the book consists of descriptions written up to trade cuts, and the greater part of the remaining contents appears to be abstracted from the numerous publications issued under the name of the same author. While the book contains much information that will interest the amateur and assist the beginner, the title is entirely misleading, as in no sense can this fragmentary compilation be considered, as implied, a general work on the theory, design or construction of dynamo-electric machinery.

PRAY'S STEAM TABLES AND ENGINE CONSTANTS. For Facilitating all Calculations upon Indicator Diagrams, or Various Problems Connected with the Operation of the Steam Engine. From reliable data, and with precision. By Thomas Pray, Jr. New York: D. Van Nostrand & Co. 127 pages. Price, $2.00.

The title page states that all of the tables in this work "were computed, not copied" and "compiled from Regnault, Rankine and Dixon, directly, making use of the exact records." There are twelve tables in all, consisting of the usual steam tables, though the arrangement of some of these is different from ordinary practice, with several special ones, as a table of engine constants, one of mean pressure multiples for each .001 of stroke, etc. Those who make lengthy steam calculations will find this book of much service, and it will be found a useful addition to the reference shelves of the engineer's library.

HOW TO BUILD A ONE-FOURTH HORSE POWER MOTOR OR DYNAMO. By A. E. Watson. Lynn: Bubier Publishing Company. 34 pages, 15 illustrations. Price, 50 cents.

HOW TO BUILD A 1,000-WATT ALTERNATING CURRENT DYNAMO OR MOTOR. By A. E. Watson. 28 pages, 15 illustrations. Price 50 cents.

These little books give working drawings for building the machines specified in the tables, accompanied by detailed information in the text. With the information thus furnished the amateur should not find it difficul to construct either of the types.

Electrical Engineering Leaflets by Prof. E. J. Houston, Ph. D., and A. E. Kennelly, F. R. A. S., published weekly by "the Electrical Engineer," New York, are apparently intended to form a course of home study somewhat after the plan of the correspondence schools originated, we believe, by Prof. E. P. Roberts. The leaflets are issued in three grades, elementary, intermediate and advanced, and the two former seem to follow closely the plan of Prof. Houston's recent volumes of Advanced Primers of Electricity, the "syllabus" at the end of each leaflet corresponding to the "primer of primers" at the end of each volume. That the instruction contained in the leaflets is correct, both as to matter and form, the high reputation of the authors gives assurance, and to those who find the reading of the usual text books on electrical subjects too formidable a task, this installment plan of attaining the same object may give the necessary encouragement to become acquainted with electrical principles.

The publisher of "Science" has issued a statement to the effect that after various negotiations with a view to the revival of that valuable journal, the publication of which was stopped on March 23 on account of the difficulty in making collections, a plan of co-operation with the American Association for the Advancement of Science was arranged at its recent meeting, by which the Association grants an annual subsidy to the journal, as do its founders, Prof. A. Graham Bell and the Hon. Gardiner G. Hubbard. To co-operate with the editor and publisher in carrying out the provisions of the agreement, the American Association appointed an Executive Committee, consisting of Prof. W. J. McGee, Chairman, Washington, D. C.; Prof. Franklin W. Hooper, Brooklyn, N. Y.; Prof. R. S. Woodward, New York; and, ex-officio, Dr. Daniel G. Brinton, Philadelphia, President of the Association; and Prof. Frederic W. Putnam, Cambridge, Mass., the Permanent Secretary. Also ten Associate Editors were designated, corresponding to the ten departments of Science recognized in the sections of the Association.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, September 29, 1894.

THE ELECTRICAL STOCK MARKET has been rather active this week, but the bearish sentiment prevailing in Wall street has militated against rising quotations accompanying the increase in activity. Wall street is just now particularly ill-disposed towards the "Industrials," and electrical stocks, coming as they do under this head, suffer the penalty of the unfavorable sentiment current.

GENERAL ELECTRIC has, however, surprised the critics by displaying unusual strength. A flood of gossip in the stock's favor has inundated Wall street. It has been related how efforts during previous weeks to depress the value of the stock have only resulted in the accumulation of an unwieldy short interest, and that any news flattering to the stock must bring about purchases for this account that will lend unusual strength to General Electrics' quotation. This state of affairs has now come to pass, and in consequence General Electric's course has been marked by a strength that rendered it a most conspicuous feature of the entire stock market. If half what is told about the stock is true, then there is ample reason for the good feeling on the stock extant. In the first place the company has now paid off the last dollar of its floating indebtedness, and, after doing so, has still a cash balance of $425,000, besides $125,000 deposited to meet December bonded interest. Indorsements and guarantees now amount to $170,000. Moreover, besides accumulating this cash fund, the General Electric Company has purchased $650,000 of its own 5 per cent. bonds, which are now held in the treasury. These bonds cost, perhaps, $500,000. Add to this the $550,000 cash, and there are quick assets of $1,050,000, with less than $300,000 of interest and endorsements, which latter will soon be paid off. Best of all, it is officially reported that for some time the company's income has exceeded its expenditures to such an extent that it has become a problem how to profitably invest the cash resources. From this statement it may easily be imagined how big a business the company now does. It is now believed that the business of the General Electric Company will put up $15 000,000, this fiscal year, or fully equal to that of last year, whereas some months it was expected that gross business would not be more than 70 per cent. of last year's total. Within the past few weeks, however, business has improved steadily, so that it is now almost double what it was during the panic. Though working to its fullest capacity, the company is pressed with orders, and, as all orders are taken on the new cash basis, people close to the management are looking forward to a very prosperous season. Were it not for the impairment of capital, dividend payments on the preferred stock could be resumed at an early date. Nothing more relative to this matter has, however, developed since what was repeated in these columns last week. Right here it would be well to quote an extract or two from a study of General Electric's situation recently published by the Boston News Bureau. There is a good deal of common sense in the statement that the real strength of General Electric to-day is in the changed basis of the company's operations. It no longer seeks to control by patent monopoly or aggregation of capital, but by the more businesslike plan of manufacturing the largest amount of goods at the minimum of cost. The review has this to say: For some years small concerns have been eating into the manufacturing and supply business of the General Electric by working on special articles. The General Electric has now reached forth to retake the field upon the basis of manufacturing each article at a cost based upon the consumption of the whole country, and the result is seen in the falling of electric supply companies, several of the strongest having gone to the wall very recently. General Electric also has a few large projects on hand where outside sindicates will supply the money and the General Electric Company the apparatus.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	10	30
Cleveland General Electric	100	80	90
Detroit Electrical Works	10	3	4
East River Electric Light Co.	100	—	50
Edison Electric Ill., New York	100	101	102⅛
" " " Brooklyn	100	102⅝	103
" " " Boston	100	120	121
" " " Chicago	100	135	145
" " " Philadelphia	100	122	124
Edison Electric Light of Europe	100	1	3
Edison Ore Milling	100	10	15
Electric Construction & Supply Co., com.	15	7⅛	10
" " " pref.	15	7½	10
Fort Wayne Electric	100	2⅞	3
General Electric	100	38¼	38⅜
General Electric pref	—	70	72
Interior Conduit & Ins. Co.	100	35	45
Mount Morris Electric	100	25	50
Westinghouse Consolidated, com.	50	34½	35½
" " " pref	50	52	53

BONDS.

*Edison Electric Ill., New York	1,000	107⅝	108
Edison Electric Light of Europe	194	75	85
General Electric Co., deb. 5's	1,000	94	95

TELEGRAPH AND TELEPHONE.

*American Bell Telephone	100	207	208
American District Telegraph	100	41	45
American Telegraph & Cable	100	90½	91
*Central & South American Telegraph	100	105	110
*Commercial Cables	100	125	145
Erie Telephone	—	51	52
Gold & Stock Telegraph	100	100	103
Mexican Telegraph	100	185	200
New England Telephone		68	69
*Western Union Telegraph	—	87¾	88
*Ex-div.	100		

AMERICAN BELL TELEPHONE has been the second most active electrical stock, though its operations are confined to the Boston Board. Its stockholders were very much gratified this week by the declaration of an extra dividend of 1½ per cent. out of earnings for the first six months of the year, in addition to the regular quarterly distribution of $3 per share. As the dividend for the corresponding quarter of 1893 was only the regular 3 per cent. without any extras, the improvement in business is clearly evidenced. It is made even more manifest by the publication of the figures of instrument output during the month ending September 20. The gross output was 9,234 telephones, or 5,699 more than in 1893; instruments returned amounted to 6,666, an increase of 305, so that the net output is 2,568, whereas for the same period of 1893, there were 2,826 more telephones returned than put out. The total figures since December 20 last, still show, however, traces of the hard times during the earlier months of the year. Gross output was 62,378, a decrease of 4,784; returned, 53,646, increase $7,937; net output 8,732, decrease, 12,721. These losses will, however, at the present rate of business, be more than made up before December 20 comes around again, so that the year will turn out fully as well if not better than 1893, though that was hardly up to the mark.

WESTINGHOUSE ELECTRIC issues are very quiet. The company has become involved in one or two more lawsuits bearing on infringements by competitors of valuable patents, but this kind of thing has long since failed to arouse any kind of interest in stock market circles. A big business, it is reported, is being done, and many orders will be forced to remain unfilled till the increased capacity of the new Brinton works is given a chance of demonstration.

WESTERN UNION TELEGRAPH stock has not displayed much life of recent days. There continues to be a little investment buying of the stock, but its growing scarcity—in floating quantities—acts as a deterrent on any projected speculative movement in either direction. Quotations are well held.

THE BOSTON ELECTRIC LIGHT COMPANY has declared a quarterly dividend of $2 per share. It is payable to-day.

New Incorporations.

THE PORT HURON & LEXINGTON RAILWAY COMPANY, Port Huron, Mich., has been incorporated to build a street railway.

THE LONDON ELECTRIC COMPANY, London, Ontario, has been incorporated with a capital stock of $250,000. C. B. Hunt is interested.

THE MAYFIELD & STANFORD, JR., UNIVERSITY STREET RAILWAY COMPANY, Mayfield, Cal., capital stock $10,000. J. P. Ponce, B. Mayer, Gordon Wigle and B. L. Ryder are the promoters.

THE NEXOPHONE COMPANY, Chicago, Ill., capital stock $200,000, has been formed to make, sell and lease nexophones and other electrical appliances. F. N. W. Campbell, Freeman Campbell and C. E. Congleton are interested.

THE CITIZENS' ELECTRIC COMPANY, Springfield, Ill., capital stock $60,000, has been formed to produce and supply electricity for light, heat and power, etc. J. McCreery, F. D. Buck, T. H. Coleman, P. N. Harts and E. A. Wilson are interested.

THE NATIONAL TELEPHONE CONSTRUCTION COMPANY, Gainesville, Tex., has been incorporated by J. M. Dubois, Geo. P. Funkhouser, J. M. Lindsey, L. B. Lindsey and C. R. Smith, to build and operate telephone lines. The capital stock is $25,000.

THE CUMBERLAND LIGHT, HEAT AND POWER COMPANY, Mechanicsburg, Pa., capital stock $50,000, has been formed to supply light, heat and power by means of electricity to that town. Geo. W. Cumbler, Fred H. Alleman and J. D. Lander, Steelton, Pa., are interested.

THE ELECTRIC RAILWAY & PARK COMPANY, Clinton, Iowa, capital stock $40,000, has been formed to construct and operate street railways, and to own and operate a pleasure park. A. L. Schuyler, C. Coa. E. C. Walsh, A. L. Stine, M. A. Walsh, J. W. Walsh, all of Clinton, are interested.

THE GARVIN ELECTRICAL MANUFACTURING COMPANY, Portland, Or., capital stock $5,000, has been formed to manufacture, purchase and lease telephones, phonographs and all other classes and kinds of electrical inventions. Wm. H. Garven, Thos. B. Howes and S. I. Barber, Portland, Ore., are the organizers.

THE TEXAS PACIFIC MERCANTILE AND MANUFACTURING COMPANY, Ft. Worth, Texas, capital stock $20,000, has been formed to construct a telegraph and telephone line, etc. R. D. Hunter, H. C. Edrington, H. K. Thurber, S. Mims, W. G. Newby, Ft. Worth, Tex.; and C. V. Siddell, New York, are the promoters.

THE N. W. TURNER COMPANY, 29 Bromfield street, Boston, Mass., capital stock $10,000, has been formed to purchase and sell electric and gas fixtures, lamp goods and merchandise at wholesale and retail. C. B. Knott, 22 St. Johns street; W. T. Knott, 29 Bromfield street, and Wm. F. Schallenbach, same address, are the incoprorators.

THE CO-OPERATIVE CONSTRUCTION AND SUPPLY COMPANY, Norwalk, O., capital stock $20,000, has been formed to construct, repair, make and sell steam power, electrical current, and electrical and hydraulic engineering works and fittings, etc. D. B. Kuhn, Wm. S. Bayley, Wm. J. Bowen, J. Comesky and M. Muller are interested.

THE AMERICAN ELECTRIC SMELTING COMPANY, Wheeling, W. Va., maximum capital stock $1,000,000, has been incorporated to manufacture aluminum and other metals by electric or other processes for the production of articles of like nature, etc. John A. Campbell, Charles Menkenmeller, Thomas H. B. Haase, Wheeling, are interested.

THE WADSWORTH GENERAL ELECTRIC COMPANY, Wadsworth, Ohio, capital stock $10,000, has been formed to build and operate electric railways, telephone and telegraph lines, to furnish electric power, etc. W. B. Hunaberger, E. Overholt, J. A. Clark, A. M. Back, F. G. McCauley, O. V. Dibble, J. P. Baldwin and J. G. Grisemer are the promoters.

THE ELECTRIC POWER COMPANY, Los Angeles, Cal., capital stock $1,000,000, has been formed to develop, sell and distribute electricity for light, heat and power; to build electric, water and other works, railway lines, etc., and to operate same. E. C. Seymour, P. Kehl, W. E. Van Slyke, San Bernardino; M. L. Graff and H. W. Latham, Los Angeles, Cal.

THE PHILADELPHIA, BALA AND NARBERTH RAILWAY COMPANY, Philadelphia, Pa., capital stock $24,000, has been formed to construct, maintain and operate an electric railway. The promoters are A. L. Pretz, Cynwyd; G. Morris Dorrance, Bristol, and J. L. Stadelman, Bala, Pa.

THE CHILLICOTHE ELECTRIC RAILROAD, LIGHT AND POWER COMPANY, Chillicothe, Ohio, capital stock $100,000, has been formed to build, acqurie and operate electric, horse or other motive power street railroads, and to furnish electric light and power, etc. Joseph P. Myers, John A. Poland, W. A. Story, Richard Enderling and Joseph M. Klingelsmith are the promoters.

Special Correspondence.

New York Notes.

Office of The Electrical World,
253 Broadway, New York, Oct. 1, 1894.

ALLAN R. FOOTE, of Washington, was in the city last week.

H. B. COHO & CO., 203 Broadway, announce the sale of some small Mather generators the past week, one being for export. They feel quite encouraged by the outlook for business.

MR. C. C. CALDWELL is giving successful stereoptican exhibitions at county fairs and elsewhere, one of the principal features of which is a large number of views of electrical applications.

MR. HALL, of the C. & C. Electric Co., 143 Liberty, street, New York, reports business steadily improving to such an extent as to leave no doubt of the revival of business having a substantial nature.

MR. WALTER F. PHELPS, president of the Dayton, Ohio, Fan and Motor Company, is in New York on a vacation trip. Mr. Phelps reports business excellent, and he feels highly encouraged as to the prospects for the future.

MR. BEN NAHM, president of the American Electrical Manufacturing Company, St. Louis, manufacturer of the American incandescent lamp, has established a New York office at 105 Havemeyer building, of which he will take personal charge.

MR. FRANCIS JEHL, an electrical engineer who has been connected with the old Edison Company in Europe for the past fourteen years, arrived on the steamship Paris of the American line Saturday, September 22. He will shortly locate in this city, where he will represent the firm of Hardmuth & Co., the well known graphite pencil and electric light carbon manufacturers of Vienna, Austria.

ELECTRIC CARS TO CARRY MAILS.—Second Assistant Postmaster General Nelson is giving a deal of attention to special mail service in large cities. He has ordered prepared maps of all large cities showing the surface car lines, with a view of having mail cars run over them. He expects to give his attention especially to carrying mail on electric cars which run from centers of cities to the suburbs and to adjoining smaller towns.

R. F. DOWNING & CO., 13 Williams street, New York, have now ready for delivery their new United States Customs Tariff manual. The book contains 532 pages in convenient hand book form. The alphabetical schedules embrace twenty thousand articles of import, designated by their trade names, with proper rates of duty set opposite the paragraphs in the text of the bill, and references to all decisions of the Courts, Appraisers and Treasury up to date. In addition they have included special articles on doubtful points, together with tables for the reduction of foreign currency, rates of storage and labor at this port, customs capacities of liquors, and many other spcial points. Every line has been carefully revised by the best customs experts. The price of this valuable compilation is $1.00.

THE NORFOLK & WESTERN RAILROAD COMPANY will run a special train to the Convention of the American Street Railway Association, leaving New York, October 15, at 3 p. m. and reach Atlanta at 6 p. m. the next day. A special car will be reserved for gentlemen accompanied by ladies. Among the prominent passengers by this train will be the following: Benj. Norton, president Atlantic Avenue Railroad Company; Jas. H. McGraw, "Street Railway Journal"; E. Peckham, Peckham Motor, Truck and Wheel Company; Henry C. Payne, president American Street Railway Association; P. C. Ackerman, American Electric Company; E. Martin, vice-president Hamilton Street Railway Company; C. O. Baker, Jr., Complete Electric Construction Company; Wm. J. Richardson, secretary American Street Railway Association; E. J. Wessels, Genett Air-Brake Company; Geo. F. Porter, secretary National Electric Light Association; J. B. Griffith, manager Hamilton Street Railway Company; W. J. Clark, General Electric Company; T. E. Crossman, assistant to secretary American Street Railway Association; Wm. W. Cole, superintendent West Side Railroad Company, Elmira, N. Y.; H. C. Evans, the Johnson Company; Lewis J. Perine, Jr., president Trenton Passenger Railway; J. H. Woodward, Benedict & Burnham Manufacturing Co.

Canadian Notes.

Ottawa, Sept. 27, 1894.

ROBIN & SADLER, Montreal, have removed to 511 William street, just a few steps around the corner from the old stand, and opposite John McDougall's Caledonia Works.

STRATFORD, ONT.—The City Council has adopted a scheme for acquiring its own electric light plant, and proposes building a fire hall and electric light station combined. The scheme, it is claimed, will effect a saving all round of between $3,000 and $4,000 per annum.

WINNIPEG.—George H. Campbell, of the Winnipeg Electric Railway, will, with other investors, shortly apply to the Department of Agriculture for a patent on a new agricultural machine. It is described as a "combination of ten plows and thresher, the machine going through the fields at the rate of about two acres an hour and threshing at the rate of 1,000 bushels per day.

TORONTO.—Engineer Keating's report on the electric light tenders was considered by the Fire and Light Committee. The report of Mr. Keating states that the lowest tender received for street lighting is that of the Toronto Electric Light Company, it being 20½ cents per night, or $74.82 per light per year. The tender of Bertran & Co. is pronounced the most satisfactory of those received for engine equipment, and includes boilers, feed pumps, condensers, water and steam piping, etc. The total amount of the tender is $78.729. The Brush Electric Company, of Cleveland, O., put in the lowest tender for dynamos, the price being $27,201 for twelve 125 arc light machines. The same company is the lowest on lamps, their bid being $23 each for double carbon arc lights.

OTTAWA, ONT.—The Government Statistician has prepared a statement on the subject of lighting in Canada. The establishments in this group have increased from 108 in 1881 to 225 in 1891. Mr. Johnson's comment on this group is: "In this group considerable changes have taken place during the ten years. Electricity has been given a commanding position, and though gas works have increased from 36 in 1881 to 49 in 1891 and their continued value to the wage-earner is seen in the fact that 1,164 hands were employed in 1891 against 1,062 in 1881, yet against the two employed returned in 1881 as connected with electricity there were 1,190 wage earners in 1891. Electricity as a motive power has been adopted by thirty companies, having 256 miles of railway thus operated. This development has its influence upon other industries, such as street car building, and any industries in connection with iron and steel, etc."

ENGLISH NOTES.

(From our own Correspondent.)

LONDON, England, Sept. 19, 1894.

GAS MOTOR CARS.—In a recent presidential address to the Institution of Mechanical Engineers, Prof. A. B. W. Kennedy excited the ire of electrical engineers up and down the country by his eulogistic references to the gas motor car. Prof. Kennedy was promptly informed by all electric traction men that he had mistaken his vocation, and the many advantages which the electric car has over the gas car were hurled at his head. It must be said that up to the present the gas car has scarcely justified its existence. A car with all the latest improvements has been running for some little time past down at Croydon, and even if we leave out of consideration the liability to explosion and the expense, the smell, heat and the noise should be quite sufficient to make the unsophisticated public prefer the electric car. However, notwithstanding all this, a line which it was generally supposed would be run by electricity, viz., that from Blackpool to St. Anne's and Lytham, as it would now appear is to be operated on the Luhrig self-contained gas car principle. The line is some eight miles long, and will derive its income chiefly from holiday traffic. It will be interesting to observe whether the contract cost of running, 4½ per car mile, including gas, drivers' wages and repairs, will be profitable in practice.

ELECTRIC COMMUNICATION WITH ROCK LIGHTHOUSES.—At the conclusion of the inquiry into the recent stranding of the magnificent Cape liner "Dunottar Castle" on the Eddystone rock, the representative of the owners said they courted the inquiry because it seemed to them to attract attention to the absolute necessity for having telegraphic communication between rock lighthouses and the shore. In this case the value of the ship and cargo amounted to over £300,000, and there were 400 souls on board, and the ship was within measurable distance of being totally lost for want of assistance which might readily have been obtained from Plymouth if there had been the means of communication. The court, after giving juddgment, added, with reference to the suggested cable, that it would consider the subject and report thereon.

LOCAL AUTHORITIES AND TELEPHONE POLES.—Local authorities, especially in Scotland, have lately shown a strong disposition to imitate the somewhat arbitrary methods which apparently obtain in the United States in regard to telephone poles and similar public obstructions. Thus the Fife County Road Board has recently addressed a peremptory ultimatum to the National Telephone Company to the effect that it must pay the Board a rent of two shillings per pole per annum, or "lift them."

"L'ECLAIRAGE ELECTRIQUE."—Within a month of the disappearance of the old established French journal, "La Lumiere Electrique," M. Paul Ledeboer has stepped into the gap with a similar publication called "L'Eclairage Electrique."

News of the Week.

TELEGRAPH AND TELEPHONE.

CALVERT, TEX.—Jas. T. Fuller is building several telephone exchanges.

GAINESVLLE, FLA.—The Bell Telephone Company are about to put in a telephone exchange.

VICKSBURG, MISS.—The construction of a telephone line from Vicksburg to Port Gibson is proposed.

RICHMOND, KY.—Chas. S. Powell and others have been granted a franchise to construct a telephone system.

FLORENCE, S. C.—C. L. Goodman and W. B. Willeford, Atlanta, Ga., are arranging to establish a telephone system in Florence.

WACO, TEX.—A company from Chicago, Ill., represented by Chas. R. Pengilly, contemplates the esablishment of a telephone exchange in Waco.

ABBEVVLLE, LA.—D. L. McPherson is organizing a company to establish a telephone exchange, and is in the market for the necessary equipment.

NATCHEZ, MISS.—The Great Southern Telephone Company contemplates constructing a telephone line from Natchez to Vidalia, including a cable in the Mississippi river.

NATCHEZ, MISS.—The Great Southern Telephone & Telegraph Company contemplates constructing a telephone line from Natches to Vidalia, including a sunken cable in the Mississippi.

GREENVILLE, TEXAS.—The Western Telephone Construction Company will establish the proposed telephone exchange in Greenville. J. M. Ragsdale, of Waxachachie is at the head of the enterprise.

BERLIN, WIS.—The Waushara Telephone Company was organized in Berlin, to construct, maintain and operate a telephone line from Berlin to Wautoma and other places. John Moffott, of Poy Sippi, is president.

ELECTRIC LIGHT AND POWER.

PLANO, TEX.—The establishment of an electric light plant is contemplated.

IRVINGTON, N. J.—A new town hall will be erected, to be lighted by electricity.

MARTIN'S FERRY, O.—The proposition to issue $30,000 electric light bonds was carried.

SUDBURY, ONT.—An electric light and water works are to be established in Sudbury, at a cost of $40,000.

GREENVILLE, ALA.—The Greenville Mills and Ice Factory contemplates erecting an electric light plant.

WACO, TEXAS.—The Mayor authorized the Gas Committee and City Engineer to prepare plans for city lighting.

QUINCY, FLA.—The Owl Cigar Company will establish a cigar box factory and put in an electric light plant.

WINNEBAGO CITY, MINN.—The Village Council is investigating the matter of putting in an electric light plant.

BARTOW, FLA.—Steps are being taken to secure the erection of an electric ight plant. The Mayor can be addressed.

BANGOR, ME., is agitating the question of puttting in a new electric light station at the water-works, to cost $25 000.

ST. CHARLES, MO.—A movement is on foot for the establishment of a municipal electric light plant in that city.

GREENVILLE, TEX.—Messrs. Moffitt and Goldsby and W. H. Goldsby are reported to be erecting an electric light plant.

NEW BIRMINGHAM, TEX.—Wm. C. Cloyd can give information regarding the construction of an electric light plant for that city.

MOBERLY, MO.—W. F. Elliott can give information concerning the organization of a stock company to erect an electric light plant.

NOKOMIS, ILL.—The city has issued bonds for a water system, and is considering the question of putting in an electric light plant.

WEST CHESTER, PA.—A new electric light plant is needed. Member Heston, of the Borough Council, can probably give information.

MOBERLY, MO.—The organization of a stock company to erect an electri light plant is proposed. W. F. Elliott can give information.

MORGANFIELD, KY., is putting in an electric plant, the power to be furnished by an engine built by the Ball Engine Company, Erie, Pa.

GREENVILLE, ALA.—The Greenville Mills and Ice Facory are in the market for electric light machinery and desire correspondenc regarding the same.

ASHLAND, KY.—A move is reported on foot for the organization of a company to establish an electric light plant. The proposed capital stock is $8,000.

HOPKINSVILLE, KY.—The Hopkinsville Water, Light & Power Company, Hopkinsville, Ky., has submitied a proposition to light that city by electricity.

MT. MORRIS, N. Y.—Mr. Cariton, a mechanical engineer from Buffalo, accompanied Mr. Metzer to prepare plans and specifications for the electric light plant.

CARBONDALE, PA.—A franchise was granted to the Carbondale and Forest City Electric Street Railway. It will build through Gordon avenue and other streets.

LEBANON, N. H.—The Lebanon Electric Light & Power Company is installing a 150-hp cross compound engine, built by the Ball Engine Company, Erie, Pa.

ALEXANDRIA, LA.—The Southern Electrical & Supply Co., of New Orleans, has been awarded a contract for constructing an electric light and water works for that city.

LULING, TEXAS.—The question of lighting the city with electricity is again being agitated. Luling, with her splendid water-power, could operate the plant at a low cost.

COWPENS, S. C.—J. E. Duval, Charlotte, N. C., has been awarded the contract for installing a 250-light electric plant in the mill of the Cowpens Manufactur ing Company.

SPRINGFIELD., TENN.—Address J. W. Bell concerning the lighting of that city by electricity.

NORFOLK, VA.—E. J. Acker, of the Acker Consruction Company, has applied for a franchise to furnish gas and electric light and to construct a sewerage system in Brambleton.

TACOMA, WASH.—A. J. Haywood is interested in a project to develop the water power of the Nisqually river by a dam, to operate the city electric light plant. The estimated cost is $75,000.

HAMDEN, N. Y., is talking about electric lights. It has been estimated the cost will be $300 per aunum, owing to the free use of water power, which a citizen has consented to donate.

BIG RUN, PA.—The Big Run Manufacturing Company is in the market for a second-hand outfit, complete, with the exception of power, for elecric lights, 100 to 150 lights capacity.

MERIDIAN, MISS.—C. M. Rubush has been awarded the contract by the Meridian Gas Light Company for the erection of its new electric plant to take the place of the one recently burned.

PEORIA, ILL.—The special committee recommended that the County Board appropriate $5,000 for the erection of an electric plant tc light the county buildings, and that plans and specifications be prepared.

OSWEGO, N. Y.—Sealed proposals will be received until October 15, for supplying electric lights in the streets and municipal buildings for a term of five years, from February 20, 1895. Address Board of Public Works.

CYNTHIA, KY.—Sealed proposals will be received until October 9, for furnishing not less than 25 arc lights of 1,200 nominal candle-power each, and not less than 40 incandescent lights of 24-cp each. L. S. Williams is city clerk.

OAKLAND, ME.—The Waterman Machine Tool Company is in the market for a new or second hand electric lighting outfit; also 10-hp dynamo, about eight arc and from 25 to 50 incandescent 16-cp lights, wiring, etc., complete.

PELZER, S. C.—The Pelzer Manufacturing Company will build a new cotton mill and is considering the matter of having it operated by electric power, to be generated at a point two miles from the mill site. S. Clark is superintendent.

PORTLAND, ORE.—The plant of the Portland Electric Company, which had just arrived from Lynn, Mass., and was not unloaded, has been burned. The plant occupied the whole train, and the machinery was of the most expensive kind.

SHIPPENSBURG, PA.—The Shippensburg Electric Light, Heat & Power Company has secured a renewal of its contract to light the streets of Shippensburg, Pa., for three years from October 1, 1894—to furnish 19 2,000-cp arc lamps at $70 per lamp per annum, and 11 32-cp incandescent at $18 per lamp per year, dusk to midnight, moonlight schedule.

ROME, N. Y.—Sealed proposals for lighting the streets of Rome with electric lights will be received until 7.30 p. m., October 15. Proposals must be for one, three and six years, for 150 arc lights, more or less, of 2,000-candle power, to be lighted every night from sunset to sunrise. For further particulars address Alderman Charles A. Fowler, chairman of Lamp Committee.

AVON, N. Y.—The Avon Electric Company has organized, with Mr. C. J. Bastendorff and A. R. Young, of Le Roy, N. Y. These gentlemen are building a solid stone fire-proof building for a power house, having received a contract for five years for 25 arc lights to light the village. They have bought a 50-kw Fort Wayne 1,000-light alternator and a 35-light Wood arc machine complete, with double lamps and other equipment. The plant will be in operation by the first of November. O. K. weather-proof line wire and Schieren's perforated belts will be used.

THE ELECTRIC RAILWAY.

ST. AUGUSTINE, FLA.—Bonds to the amount of $150,000 will be issued to build an electric line.

ASHVILLE, N. C.—J. E. Dickerson is in the market for new or second-hand vestibuled closed cars.

LANCASTER, PA.—The Lancaster Construction Company will build the new electric road at New Holland.

FREEPORT, ILL.—The Freeport Electric Railway has purchased a 150-hp engine from the Ball Engine Company, Erie, Pa.

MANITOU, COL.—An electric road will be constructed at a cost of $50,000. It is reported that the road will be in operation April 1.

RALEIGH, N. C.—The Raleigh Street Railway Company is reported to be arranging to put in a system of incandescent lighting.

DELAND, FLA.—It is reported that work is to begin on the proposed electric railroad at an early date. John B. Stetson is interested.

LANCASTER, PA.—New York capitalists are surveying a line from Trenton, N. J., to Lancaster, Pa., for the purpose of building an electric road.

MOUNDSVILLE, W. VA.—Contractors are making estimates for constructing an electric railway. Wareham & Hughes, Beaver Falls, Pa., are interested.

BALTIMORE, MD.—The Baltimore Traction Company is about to put an additional 500-hp engine in the Retreat street power house; also an engine in the St. Charles street power house. Frank Hambleton is chief engineer of the company.

SYRACUSE, N. Y.—The Syracuse Street Railway Company has been granted permission by the State Railway Commission to use electric power on the People's Line.

BENNINGTON, VT.—A movement is on foot to build an electric line. H. S. Bingham, president of the village, was elected chairman, and Harry T. Cushman secretary.

INDIANAPOLIS, IND.—The Indianapolis, Alexandria & Marion Electric Railway is said to be a sure thing and the work of construction will shortly be commenced.

HOUSTON, TEXAS.—The Houston Suburban Railway Company has been granted a franchise to build a road along several city streets. Judge J. G. Tod may be addressed.

RICHMOND, VA.—The City Council will endeavor to have the Richmond Railway & Electric Company use electric motors on its Broad street line. G. E. Fisher is general manager.

DANBURY, CONN.—The Wardwell Bros., of New Haven, Conn., have been awarded the contract for constructing the Danbury and Bethel electric road, to be completed by January 1.

M'KEESPORT, PA.—The Highland and Dravosburg Electric road has leased the McKeesport & Reynoldton road, whose tracks are laid to the Dravosburg bridge over the Monongahela River.

BLOOMFIELD, N. Y.—At the meeting of the Bloomfield Township Committee an ordinance was introduced granting the Suburban Traction Company permission to use electricity in running cars.

DELAVAN, WIS.—Chicago parties have petitioned the City Council for right of way for an electric line from Delavan to the lake. Should the franchise be granted work will commence right away.

CHATTANOOGA, TENN.—The North Chattanooga Electric Railway Company proposes to build an incline road up Walden's Ridge. The promoters of the new line are C. E. James and T. J. Nichol.

PHILADELPHIA, PA.—An ordinance has been passed granting permission to the East Aramingo Passenger Railway Company to lay tracks on Aramingo avenue, erect poles and operate the road with electricity.

QUINCY, MASS.—The Quincy & Boston Street Railway Company has petitioned the council for a location for the extension of its tracks on the northerly side of Willard street. Christopher A. Spear is clerk of Council.

COVINGTON, KY.—The South Covington Cincinnati Street Railway Company, of which J. J. Shipperd is president, will rebuild its line. Electric equipment, poles, rails, etc., for three miles of track will be needed.

COLUMBUS, GA.—The Columbus Railroad Company is contemplating the erection of a power house to operate their lines by electricity.

CANAJOHARIE, N. Y.—It is an assured fact that Canajoharie is to have an electric road, to run to Sharon Springs and to connect with the New York Central & West Shore Railways. The business men will call a meeting and act at once.

WESTERLY, R. I.—It is not at all improbable that before another year there will be an electric road between Westerly and Potter Hill. The officials of the Pawtucket Valley Street Railroad Company are now considering whether the extension is advisable.

NEW ORLEANS, LA.—The New Orleans Street Railway Company has decided to use the trolley system for its lines, and will rebuild them for this purpose. L. T. Petitpain is secretary and H. J. Malochee, engineer. Nineteen miles of track will be laid in all.

CHATTANOOGA, TENN.—It is reported that the North Chattanooga Electric Road is to be extended to the foot of Walden's Ridge, in the suburbs, and an inclined cable road built to the summit of the ridge. T. J. Nichol and C. E. James are said to be interested.

BALTIMORE, MD.—The Baltimore Traction Company will put in an additional 500-horse power engine in its Retreat street electric power-house; also, a similar engine in its South Charles street power-house. Frank Hambleton is chief engineer of the company.

SYRACUSE, N. Y.—Active measures are being taken towards organizing a new electric street railroad company. Those interested are: Frank M. Bonta, Dr. D. H. Murray, Nathan P. Graves, Allan Fobes, Lyman Stevens, Newell F. Loomis, Alfred Wilkinson, Donald Dey and others.

GETTYSBURG, PA.—The electric power-house at Gettysburg, which was destroyed by fire September 11, caused a loss of about $60,000 to Mr. Holler, the owner, who was preparing to extend his electric road in order to utilize his power and get a better return for his investment. It will be rebuilt at once and on a larger scale.

SALINA, KAS.—L. N. Erb, of Leavensworth, has made a proposition to the citizens of Salina to build an electric street railway five miles in length in this city, for a bonus of $30,000 in real estate and $500 in cash. A mass meeting has been held of the business men and capitalists and the proposition was accepted. Work will be started in thirty days.

OLD FORGE, N. Y.—The Old Forge Railroad Company has been incorporated to construct a street surface railroad two miles in length from the Fulton Chain Station, on the Adirondack and St. Lawrence Railroad, to Old Forge. John F. Luther, Charles N. White and Luella Luther, of Utica, Leander W. Fiske, Morton Henks and Dayton M. Hall, of Boonville, are interested.

WASHINGTON, D. C.—The proposed electric railway between Washington and Baltimore is now reported as fully decided upon. Surveyors have been fixing the final line of the route between Riverdale and Washington, and the entire route has been definitely settled upon. By act of the last Maryland legislature, the charter was extended six months from the first of August last.

CHICAGO, ILL.—The North Chicago Street Railway Company has applied to the Commissioner of Public Works for a permit to build and equip with electricity its lines, with proper side pole construction, on Garfield avenue from Lincoln west to Racine avenue, south on Racine avenue to Center street, and thence east on Lincoln street to Lincoln avenue and Sedgwick street. The work is to commence at once.

POTTSVILLE, PA.—A charter has recently been granted to the Pottsville & Reading Electric Railway Company, whose line is to extend from Pottsville through the principal towns to Hamburg, thence down the valley and connect with the Reading Traction Company's new line at Temple. At Pottsville the line will also connect with the principal Schuylkill county lines, thus making a complete system.

SAVANNAH, GA.—Judge Falligant denied the petition for the appointment of a receiver for the Electric Railway Company of Savannah, to which we referred recently in these columns, his decision being as follows: "As I regard it, the highest duty of a chancellor is to conserve and not to destroy the interests of property under his jurisdiction. I do not think the facts presented justify me in making what I should consider a remorseless assault upon the credit of this concern. I shall, therefore, decline to grant the prayer of the petition."

WHITE PLAINS, N. Y.—The Highway Commissioners have granted a franchise for an electric railroad which covers the Tarrytown road from Elmsford to White Plains village. Work is to be commenced in sixty days and the road completed within a year. The Moran Company, as reorganized, has the following Board of Directors: James H. Moran, V. A. Krepps, H. T. Montgomery, E. R. Phelps, John Duffy, George L. Miller, Stephen S. C. Smith, J. T. Lockwood, all of White Plains, and S. Webbei Parker, of Mamaroneck.

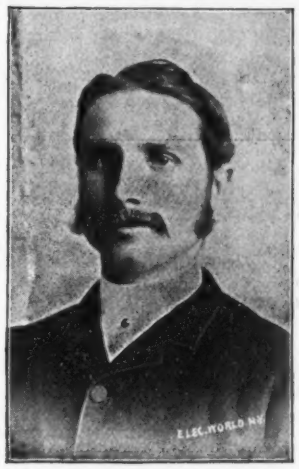
MOUNT VERNON, O.—The Central Ohio Electric Railway Company has been incorporated for the construction and operation of a complete electric railway system between Pittsburg and Chicago. The articles provide for freight, express and passenger traffic, and the hauling of the mails. Among other objects are the supplying of light, heat and power for public and private use, and the construction of telephone and telegraph lines. The headquarters of the company are at Mt. Vernon, and the eastern terminus in Ohio is Brilliant, Jefferson county, and the western Colina, Mercer county. The capital is $100 000, and the incorporators G. A. Jones, F. W. Jones, J. A. Caldwell, Wm. H. Koons and M. Spellacy.

THE FIELD ELECTRIC RAILWAY PATENT.—The recent decision against the claims of S. J. Field for a fundamental street railway patent excited but little attenion and there has been no surprise expressed at the result. The trend of judicial opinion has for some time been noticeably against claims for combinations involving an onerous monopoly, and after the apparent reluctance exhibited in sustaining a patent as strong as the Edison lamp patent, there was but little hope from the courts at any time in recent years for the Field claims. According to the terms of the decision, every part of the combination patented was old and moreover the skill involved in accomplishing the object sought to be thus protected was not such as to involve any exercise of the inventive faculty.

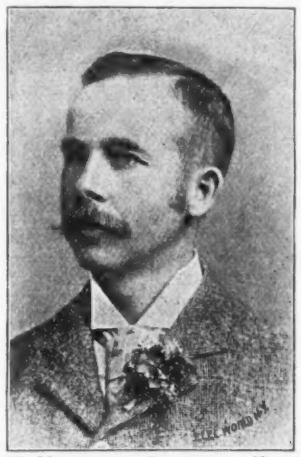
PERSONAL NOTES.

THE ASSOCIATION OF PRACTICAL ELECTRICIANS, Chicago, at its recent meeting adopted appropriate resolutions of regret at the death of Mr. Charles H. Rudd, who was an honorary member of the association.

THE CANADIAN ELECTRICAL ASSOCIATION has been especially happy in the selection of its officers, and to this is probably largely due its rapid growth in importance, which culminated in the recent very successful meeting at Montreal. The formation of the association was generally discussed as early as 1890, and in that year Mr. S. J. Parker, president of the Owen Sound Electric Light & Manufacturing Company, took the first step by obtaining expressions of opinion from leading Canadian electric light men, which were uniformly favorable. The idea was taken up with much vigor by Mr. C. H. Mortimer, the present efficient secretary-treasurer, and finally a meeting for organization was held in Toronto in November, 1891, at which Mr. J. J. Wright, manager of the Toronto Electric Light Company, was elected president, and Mr. C. H. Mortimer secretary-treasurer. At the first annual meeting in June, 1892, both of these gentlemen were re-elected. In 1893 two meetings were held at Toronto —in January and in September—at the latter of which Mr. Wright and Mr. Mortimer were again re-elected to their respective offices. At the recent meeting at Montreal, Mr. K. J. Dunstan, who had served as one of the vice-presidents from the beginning of the association, was elected president, and Mr. Mortimer continued in the position which he has so ably filled during the same per od. Mr. Dunstan is one of the officers of the Canadian Bell Telephone Company, and Mr. Mortimer is the editor of our enterprising contemporary, "Canadian Electrical News," of Toronto. The other officers elected are as follows: First Vice-President, A. B. Smith, Great Northwestern Telegraph Company, Toronto; Second Vice-President, C. B. Powell, Ottawa; Executive Committee, George Black, L. B. McFarlane, T. R. Rosebrugh, E. C. Breithaupt, John Yule, O. Higman, J. W. Taylor, D. A. Star, J. J. Wright and J. A. Kammerer.



K. J. DUNSTAN, PRESIDENT, C. E. A.



C. H. MORTIMER, SECRETARY-TREASURER C. E. A.

Trade and Industrial Notes.

THE ST. LOUIS IRON AND MACHINE WORKS, Main street and Choteau avenue, St. Louis, Mo., are building a 350-hp Corliss engine for the Pekin, Ill., Electric Light Company.

THE H. W. JOHNS MANUFACTURING COMPANY, 87 Maiden Lane, New York, in a 24-page pamphlet gives numerous illustrations of noted buildings, shops, etc., in which its heat insulator and fire protection materials are used. The designs are very neat and furnish almost a complete collection of views of the fine buildings of this country.

THE COLBURN ELECTRIC MANUFACTURING COMPANY, Fitchburg, Mass., has issued a handsome 52-page catalogue containing numerous illustrations of the several types of dynamos and motors manufactured by it, and of accessory apparatus. The catalogue is well arranged and printed, and the numerous cuts render very clear the constructions of the various apparatus.

MESSRS. ROTH & ECK, 30 Market street, Chicago, although their names are yet comparatively new to the electrical fraternity, are rapidly taking that standing which belongs to producers of high grade machines. Both members of the firm are young men, fully competent to undertake all the work entrusted to them. They will make a specialty of manufacturing dynamos from 8 to 100 lights capacity, and of motors from ⅛ to 7-hp.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., will furnish the iron roof trusses for the new city armory, at Pawtucket, R. I. Also the new power house for the Bridgeport Traction Company, at Bridgeport, Conn., consisting of a dynamo room and a boiler room, to be built of iron and brick—composite construction. The dynamo room will be controlled by a traveling crane, furnished by the same firm.

MR. W. A. FENN, of Buffalo, N. Y., for the past three and a half years general manager of the American Electrical Supply Company of that city, has severed his connection with the supply company and is now connected with the Electric Service Company, whose general offices are in the Erie Company's Savings Bank Building, Buffalo. During Mr. Fenn's connection with the Supply Company he has made many friends and has been engaged on some important electric construction work in the state.

THE GENERAL ELECTRIC COMPANY, in a large sized 64-page pamphlet, gives a complete description of its various apparatus for the electrical transmission of power. The new monocyclic system is explained and illustrated, with remarks on its field of application, and many points in regard to multiphased work are brought out. The new forms of generators, rotary and static transformers, synchronizers, etc., here shown, will be of much interest to the electrician and engineer, who will also find in this pamphlet much technical information that has not yet found its way into text-books or treatises.

THE WATERTOWN STEAM ENGINE COMPANY, Watertown, N. Y., reports the following recent sales: One 50-hp engine direct connected to a Western electric dynamo for Davidson Theatre, of Milwaukee; one 100-hp, and one 75-hp engine, direct connected to Siemens-Halske dynamo, for St. Denis Hotel, New York; one 50-hp direct connected for St. Louis. They have also on the books the following orders received within the last few days: One 100-hp for the Grand Island Light & Power Company, Grand Island, Neb.; one 50-hp for C. F. Rumpp & Sons, Philadelphia, Pa.; one 100-hp for Louisville, New Albany & Chicago Railroad, Chicago; one 40-hp for J. Mason Gross, Wakefield, R. I.

THE GENETT AIR-BRAKE COMPANY, 33 Wall street, New York, will exhibit at the approaching convention in Atlanta, its original air-brake, with varicus succeeding brakes illustrating the progress made from the start to the perfected and standardized enclosed pump brake. In addition to this, there will be exhibited all the parts in detail of the old style pump and the new style enclosed pump, and two air-brake equipments will be in operation on cars of the Atlanta Consolidated road. One of them will have the Genett testing gauge attached, by which every compression can be noted, and the small amount of power required will be shown. The exhibit will be in charge of the general manager, E. J. Wessels, and Mr. G. S. Lee, the master mechanic of the Genett Company. Mr. Wessels will read a paper on "Power Brakes vs. Hand Brakes" before the convention.

CHAS. E. GREGORY CO., 47 South Jefferson street, Chicago, send us the following list of the sales during the month of September: Home Electric Light & Power Co., Elkhart, Ind., one 50-light American arc dynamo, one 50-light Standard arc machine, 100 C. M. Edison arc lamps, 100 weather hoods, 100 globes; Mrs. S. Livingstone, city, one 1-hp Eddy motor; Eugene Vallens & Co., city, one 1-hp Belding motor; Barrett & Barrett, city, one 2-hp Excelsior motor; Henry Electric Co., Henry, Ill., one 30-light Sperry arc plant complete; O. H. Parker, Anniston, Ala., one 25-hp C. &. C. motor; Ford & McGregor, 21 Edison, M. D. arc lamps; F. Braasted, Ishpeming, Mich., one 5-hp Thomson-Houston motor; D. A. & C. A. Goodyear, Tomah, Wis., one 3-hp Jenney motor; Hatch Cutlery Co., Buchanan, Mich., one 25-kw Edison motor; Taylor, Dee & Mack, city, one 2-hp Sprague and one 10-hp U. S. motor; W. Kreilow, Willow Springs, Mo., 4 D., Thompson-Houston arc lamps; Lederrer & Oppenheimer, city, 14 Edison arc lamps; R. Roach, city, one 3-hp Eddy motor; Four Lakes Light & Power Co., Madison, Wis., one 3-hp Jenney and one 3-hp Eddy motor; Crane Elevator Co., one 1-hp Crocker-Wheeler motor; Golz & Sinclair Milwaukee, Wis., one 1-hp Eddy Motor; Racine Dredging Co., Gladstone, Mich., one 3-light Excelsior arc plant; Field Columbian Museum, city, one 45-light Brush arc dynamo and 45 lamps; D. S. Huff, Morris, Ill., one 1½-kw Edison dynamo; Chicago Turn Gemeinde, city, one 5-hp Excelsior arc motor; Dundee Rapid Transit Co., Elgin, Ill., one 20-hp Sprague motor; Quincy Floor Plate & Mfg. Co., Quincy, Ill., one 50-light U. S. dynamo; Metropolitan Electric Co., city, one 7-light Bain dynamo.

Business Notices

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

ATTENTION is called to the advertisement of the city of Oswego, New York for proposals to light the city for five years. Oswego's water-powers, ready for use, ought to attract bidders. A copy of the specifications can be seen at the office of The Electrical World.

THE SOUTHERN RAILWAY, Piedmont Air Line, announces that arrangements have been perfected for movement of members and friends of the American Street Railway Association from the East and New England States upon one of the most elegantly equipped Pullman vestibuled trains, composed of dining and sleeping cars, leaving New York Monday, October 15, 1894. The route is via the Pennsylvania Railroad and Southern Railway ("Piedmont Air Line"). Leave New York, Pennsylvania Railroad, 4.30 p.m.; leave Philadelphia, Pennsylvania Railroad, 6.55 p. m.; leave Baltimore, Pennsylvania Railroad, 9.20 p m.; leave Washington, Southern Railway, 10.43 p. m. Arrive Danville, Southern Railway, 5.30 a. m.; arrive Charlotte, Southern Railway, 9.25 a. m.; arrive Atlanta, Southern Railway, 3.55 p. m. Time, 23½ hours.

THE SOUTHERN RAILWAY owns and operates the entire line ("Piedmont Air Line") Washington, D. C., to Atlanta; also the route through "The Land of the Sky" from Washington, D. C., via Lynchburg, Va., Danville, Va., Salisbury, N. C., Asheville, N. C., Knoxville and Chattanooga, Tenn., to Atlanta, and are prepared to handle passengers with absolute comfort and despatch by either route. The route of travel is through the fertile territory known as the Piedmont regions, and presents one of the most beautiful combinations of varied and attractive scenery.

For the occasion of the meeting of the American Street Railway Association, the following rate has been made: One full fare going, and, upon presentation of certificate, one-third fare returning. If you are going to Atlanta to attend the Street Railway Convention, remember the Southern Railway, in connection with the Pennsylvania Railroad, operates a solid Pullman vestibule limited, leaving New York daily at 4.30 p. m., arriving in Atlanta next day at 3.55 p. m., with dining car service. Returning, leaves Atlanta at 1.00 p. m., arrives New York following afternoon at 1.23. The only train having a through Pullman service between New York and Atlanta. Those who desire to take the trip should arrange in advance for sleeping car accommodations (no coaches) by advising early as possible; already a large number have secured space. Five sleepers are already booked from New York, which, on arrival in Washington via Pennsylvania Railroad, will be attached to the through train on the Southern Railway for Atlanta. Representatives of Lewis & Fowler, H. W. Johns, the Okonite Company, the Walker Manufacturing Company, and E. P. Hatch, of the Boston Street Railway Company; J. H. Cunningham, president of the Massachusetts Street Railway Association; the Boston Electric Club, and other prominent people have already secured transportation or engaged passage. The special train will be under the personal supervision of Mr. A. S. Thweatt, Eastern Passenger Agent of the road in New York. This line is 14 hours quicker than that via N. &W R. R.

Call on or address: R. D. Carpenter, General Agent; Alex. S. Thweatt, Eastern Passenger Agent, 271 Broadway, New York. Waldo A. Pearce, New England

Agent; Geo. C. Daniels, Traveling Passenger Agent, 228 Washington street, Boston, Mass. F. B. Price, Agent, 32 South Third street, Philadelphia, Pa. L. S. Brown, General Agent, Passenger Department. Washington.

ADDRESSES WANTED.—The following members of the New York Electrical Society, who have made a change of residence, will oblige by sending their new addresses forthwith to the secretary, 534 Temple Court, New York City: M. W. Grovesteen, D. H. Washburn, J. D. Bishop, James Stewart, C. A. G. Groenbeck, C. D. U. Hobbie, C. G. Curtis, T. A. Sherman, Albert C. Barrett, C. C. Sibley, W. L. Tamblyn, E. S. Reid, C. H. Wright, J. McMahon, A. G. Holcombe, Charles Herman, W. S. Dix, J. A. Cabot, R. A. Mitchell, Thomas Bennett, A. B. Bennett, E. C. Bischoff, W. H. Ripley, J. T. Palmer, M. B. Meddler, E. C. Miller, Alex. Mackinnon, J. H. Longstreet, Herman Wetzler, C. P. Gott, A. S. Miskin, Francis E. Donohue, S. V. Hoffman, W. Schwein, James Callopy, H. T. Salmons, W. B. Heron.

The members of the society are informed that the photograph, taken by flash light, of the visitors to the Wild West Show, is now ready and can be had on application to the photographer, Stacy, 450 Fifth avenue, Brooklyn, price 50 cents.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPTEMBER 25, 1894.

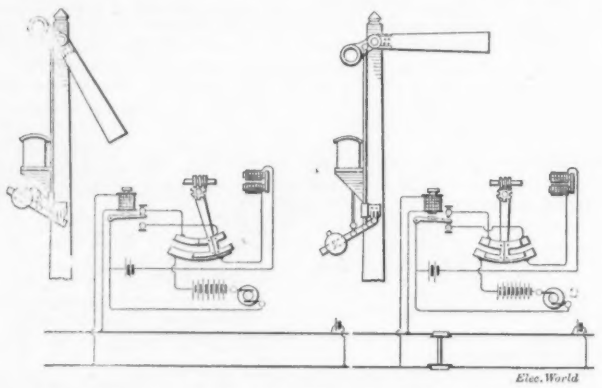
(In charge of Wm. A. Rosenbaum, 117 Times Building, New York.)

526,392. CONDUIT FOR ELECTRIC RAILWAYS; D. F. Graham, Springfield, Ohio, and W. P. Allen, Chicago, Ill. Application filed October 25, 1893. This comprises a switching device consisting of a pivoted box with a metallic contact plate therein, a plunger extending through an opening in the box also provided with a contact plate, and a pivoted connection between the plunger and a hinged plate in the conduit.

526,408. BRACKET FOR TROLLEY WIRES; L. S. Pfouts, Canton, Ohio. Application filed December 30, 1893. A pole provided with a fixed right angle arm, provided with a yoke, and a pivoted trolley wire supporting arm.

526,409. TROLLEY AND FEED WIRE BRACKET; L. S. Pfouts, Canton, Ohio. Application filed January 11, 1894. A pole provided with a pivoted supporting arm located at right angles to the trolley wire.

526,414. ELECTRIC SIGNAL APPARATUS; W. W. Salmon, Chicago, Ill. Application filed February 1, 1894. The combination of a motor, a device to be moved thereby operatively connected therewith, a brake circuit for the motor and a separate circuit for the brake, the circuit being provided with



No. 526,414.—Electric Signal Apparatus.

separate sources of energy and being so connected with the moving parts that when they have completed a predetermined movement the motor circuit is de-energized and the brake circuit is energized to retard the moving parts. (See Illustration)

526,415. ELECTRIC SIGNALLING APPARATUS; W. W. Salmon, Chicago, Ill. Application filed February 1, 1894. This comprises an electric motor, an operating circuit and a cushion circuit therefor, and a device to be moved by the motor, the circuits so operatively connected with the moving parts that when they have completed a predetermined movement the cushion circuit is energized to retard the moving parts.

526,422. TROLLEY WIRE HANGER; I. B. Walker, Sioux City, Iowa. Application filed February 26, 1894. A hanger having a central lip between the ends of the hanger, the lip and ends of the hanger being grooved for the reception of the wire.

526,432. MEANS FOR DRIVING DYNAMOS FROM CAR AXLES; W. Biddle, Brooklyn, N. Y. Application filed October 20, 1893. This comprises a transverse girder supported by the truck, suspending links suspended from said girder, bolts connecting the lower ends of the links to the pole pieces of the dynamos, and a connection from the car axle to one pole piece of the dynamo, whereby a constant distance is maintained between the car axle and dynamo.

526,434. JOINT FOR AND METHOD OF JOINING METAL BARS; W. M. Brown, Johnston, Pa. Application filed March 23, 1894. A welding chock adapted to engage the web and flange members of the rail and weld thereto.

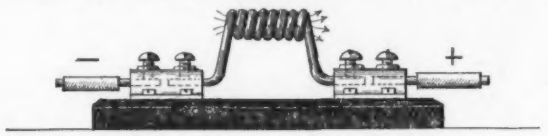
526,468. CLOSED CONDUIT FOR ELECTRIC RAILWAYS; C. D. Tisdale, Boston, Mass. Application filed September 4, 1893. A flexible tube for a conduit having a thickened upper wall and inwardly projecting longitudinal ribs.

426,472. INSULATOR FOR ELECTRIC CONDUCTORS; G. Webster, Philadelphia, Pa. Application filed July 26, 1894. An insulator having a recess in its face, one half of the recess being deeper than the other half, the deepest half forming an indirect channel from one side of the insulator to the other, and means for securing an electric conductor in the channel.

526,487. ELECTRICAL MEASURING INSTRUMENT; H. Herberts, Schenectady, N. Y. Application filed March 5, 1894. This comprises two semi-circular exciting coils connected in parallel, an armature capable of revolving concentrically to the semi-circular exciting coils, a pointer attached to the armature, and a fixed scale indicating the position of the pointer.

526,498. CONDUCTOR SUPPORT AND INSULATOR; D. N. Oysor, Columbus, Ohio. Application filed November 29, 1893. This comprises two separable parts, screw threaded on one end, and an insulating spool adapted to be screwed thereon.

526,502. ELECTRICAL SAFETY FUSE; O. Rau, Milwaukee, Wis. Application



No. 526,502.—Electrical Safety Fuse.

filed October 31, 1893. A fuse constructed with a series of turns or coils lying in close proximity to each other. (See Illustration).

526,549. ATTACHMENT FOR SPEAKING TUBES; W. Weber, Philadelphia, Pa. Application filed December 30, 1893. This consists of a rigid main tube and rigid tubular connections extending on the same side of the same, the extensions being of unequal lengths, the shorter terminating in an ear piece and the longer in a mouth piece.

526,580. TROLLEY FOR ELECTRICAL CONDUCTORS; D. N. Osyor, Columbus, Ohio. Application filed December 6, 1893. The combination of a hinged carriage or support, and the wheels carried thereon, of conductor plates in electrical contact therewith, and electrical terminals.

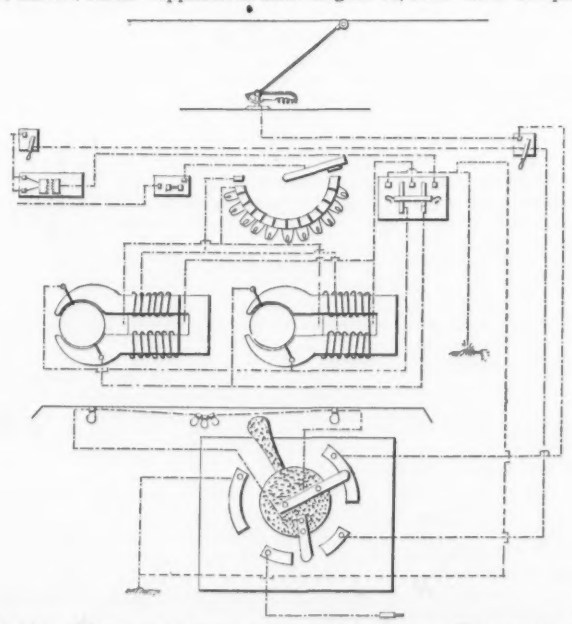
526,583. VOLTAIC REGULATOR FOR DYNAMOS. M. P. Ryder, New York, N. Y. Application filed May 12, 1894. The combination with the regular magnet and swinging armature, of a circuit breaker actuated by the armature and comprising a side plate, a conducting block insulated thereon and conducting springs secured to a stationary support and adapted to contact with the conducting plate.

526,598. ELECTRIC CAB SIGNAL FOR RAILWAYS; E. C. Wiley, Bristol, Tenn. Application filed January 31, 1894. This comprises induced electro-magnets on the car, and approximating electro-magnets arranged along the line; a normally open local circuit and battery for the inducing magnets, having two sets of terminals, one of which is closed through a visual signal, and the other of which is closed by a mechanical circuit closer operated by the passing train.

526,605. RHEOSTAT; B. E. Baker, New Britain, Conn. Application filed June 4, 1894. A rheostat consisting of cores having resistance wires wound around them, blocks of plastic material in which the cores are embedded and suitable clamping devices by which the blocks are retained in operative position.

526,609. SUBMARINE SIGNALLING; L. I. Blake, Lawrence, Kas. Application filed July 6, 1894. This comprises transmitting instruments at a shore station, and an insulated submarine conductor bared to the water at two or more points so as to establish an electrified region of communication, a conductor having its ends immersed at two point of different potentials in the area, and a telephone of low resistance in circuit therewith.

526,644. TESTING INDICATOR FOR ELECTRIC RAILWAY CARS; T. Stebbins, Boston, Mass. Application filed August 21, 1890. This comprises an



No. 526,644.—Testing Indicator for Electric Railway Cars.

indication instrument, a switching appliance having connections to the terminals of the indicating instrument respectively, switch contacts connected with the circuit or apparatus to be tested, and additional switch contacts connected respectively to a movable test plug and to ground. (See Illus.).